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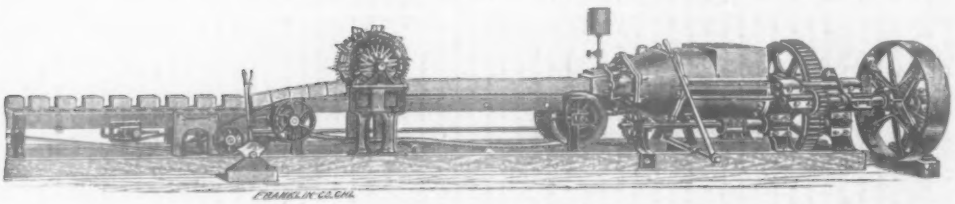

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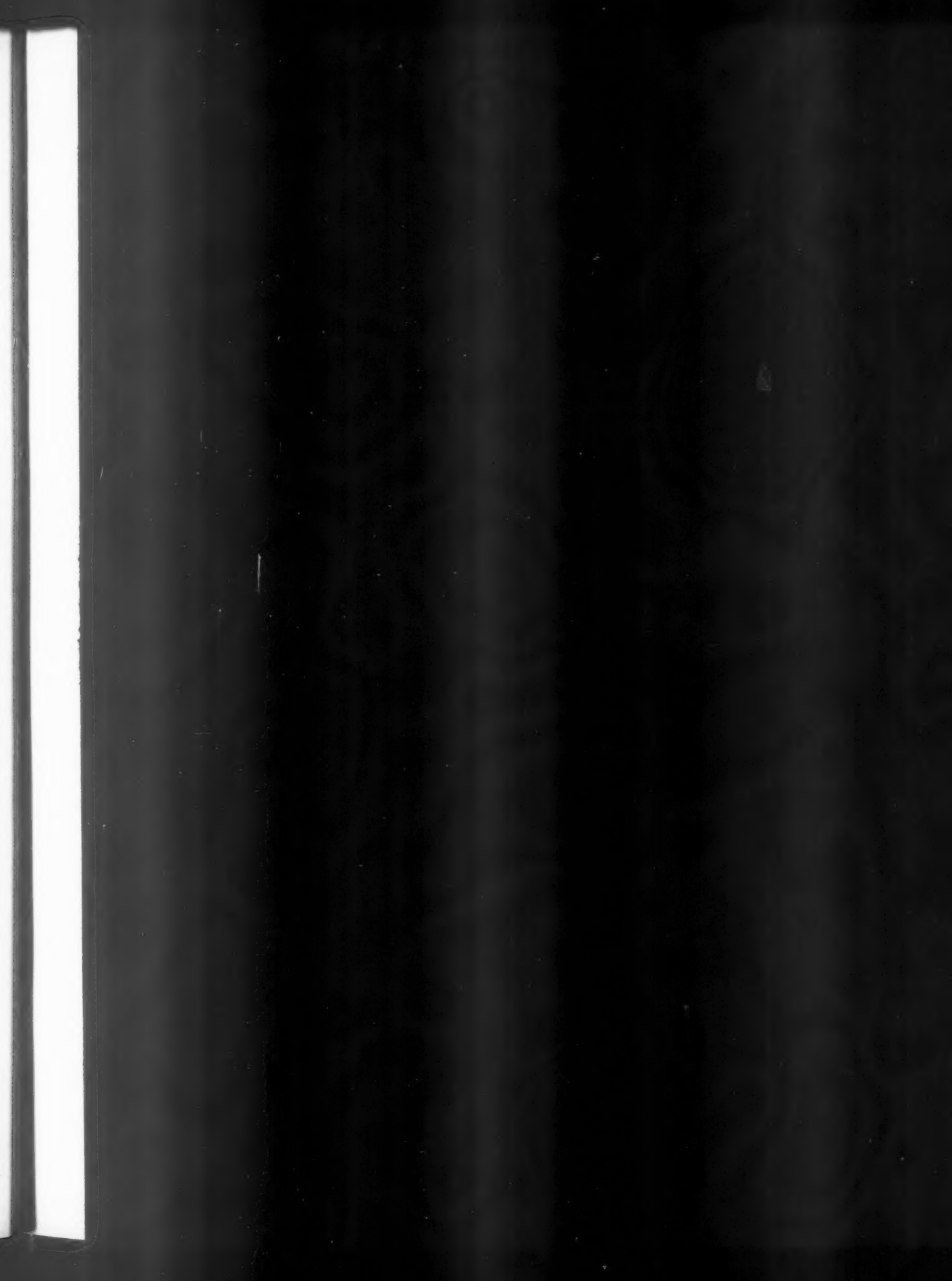

Paving and Municipal Engineering

VOLUME X. APRIL, EIGHTEEN NINETY-SIX. NUMBER 4.

WHY GOOD PAVING IS ESSENTIAL TO THE SUCCESS OF A CITY.*

By J. W. Howard, B. L., C. E.

THERE is a close relation between each individual man, woman or child, and the body politic or whole community, which intertwines the moral, mental and physical welfare of every city. The influences which build up the welfare of the individual help the city. That which promotes the welfare of the city acts at once to benefit the individual. That which degrades one degrades the other.

The scientists would say that as the whole is made up of atoms, the population of a city is made up of individuals. As an aggregation of atoms makes a molecule, and the mass is made up of molecules, similarly individuals make up families and the aggregation of families makes a community. The forces or influences, so many in number, which affect the character and success of a man, find their counterpart in all that which affects many men gathered together in a city.

There is a close analogy between the birth, growth and success or failure of a man, and the founding, development and success or failure of a city. Both have or should have means of obtaining supplies, organs for assimilation, arteries and veins through which life blood circulates. It is, indeed, an unfortunate man who has a poor circulation or who fails to properly benefit by the food which he is able to obtain. Such a man lags with heavy tread behind his fellows. The word "invalid" is stamped upon his face, although he may not know it.

If, in the above simile, we write avenues for "arteries," and streets for "veins," the reader at once sees a complete analogy, and that the city suffering because of the lack of proper avenues and streets can be regarded as an invalid city. False local pride will

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not alone suffice to enable that city to compete with others. The reader will quickly think of several cities thus enfeebled.

The above parallel could be carried further, but the suggestion is all that is necessary to demonstrate that among many things which a city needs to insure success are well paved avenues and streets.

The requirements of civilization are such that many necessities of life must be owned in common or paid for in common by every community. Among these things are the water supply, sewerage, gas or electric light, repair and cleaning of streets. Our schools, health and police departments, in fact, are but a few of the many interests for the better development of which communities are organized and proper officials chosen.

A little thought shows how closely and vitally the management, construction and maintenance of the different branches of the public work of a city are knit and woven into the daily occupations and lives of its inhabitants.

Many cities and towns have too long permitted their public matters to be administered by men who give little thought to cause and effect as applied to municipal improvements. They are too often temporary make-shifts, reducing a city, in the end, to a worse condition than before a poor pavement or other weak constructions were undertaken. The case of a poor pavement represents several other branches of public work where it is best to avoid that which soon causes enormous expense, not only to the city, by having to be replaced by something better, but also to the citizens, by the obstruction of traffic during long periods when the pavement is out of order. Moreover, the citizens are robbed of the use of the street from time to time, by having it totally closed to allow another temporary make-shift to be laid. It is far better, from whatever standpoint viewed, even that of economy, to lay such pavements which, with slight constant attention, can be kept in constant good order.

No one kind of pavement is suited to all parts of a city. The problem of the kind of pavement to use is a local one, not only for each city and town, but for each of the various parts into which they are imperceptibly divided.

Before entering upon the question of pavements it is interesting to return briefly to the development of a community and its citizens. The wealth, physical health, mental acquirements, conception of

duty and moral improvement of each man, woman and child keep pace with a like development of the town in which they live. Few men live in advance of the opportunities for improvement and success which a city properly administered should provide; most men, in fact almost all men, especially what is termed the masses, depend upon a city for their education, health, and indirectly their opportunity of gaining their livelihood. All depend upon a city government for providing sufficient and properly paved thoroughfares for the movements of men and goods.

If any one questions the possibility of a city possessing mind and conscience, and claims here a failure in the analogy, it is because he does not rise to the conception of what true municipal development can become, in fact has become, in a very few cities and towns.

The day is approaching when the advantages of a city will not only lie in its physical characteristics, its streets, water, etc., but also in its mental and moral advantages. This is already true of several places known to all. The day must come when more cities will have officials and boards of aldermen who will be known as seeking for the happy state of affairs just indicated, and not the reverse, as is now often the case, where the selfish interests of such men, and the influence of their friends, does damage to the public weal and welfare.

Man begins life first in his childhood, leaning upon others for all that he needs. A few seem never to rise above this, notwithstanding their increased age. Cities and towns, when first established, do the same. A few of them also seem to constantly depend upon other cities for their existence.

The first needs of a grown man are food, clothing and shelter. As soon as he has passed through the primitive struggles for these things, his higher traits begin to appear. His material, mental and moral wants receive increasing attention. So it is with every hamlet, village, town and city, as each gains age and becomes successful.

The beginnings of many a city were crude huts and log cabins, with irregular open spaces between the houses. Upon what at first was the mere semblance of a thoroughfare, burnt stumps of a forest clearing or the uneven ground of the prairie urged the necessity of a roadway.

Increasing population and needs of commerce and the demands of civilized comforts soon cause streets to be laid out—at least upon the map.

A water supply is discussed, sought, obtained. Drainage and sewers follow, and the place takes the name of "city,"—with lots for sale.

Schools and churches become a necessity; mental development demands them. Many other things that at first were luxuries are now necessities.

Pavements at first not needed become one of the greatest necessities. The community has finally arrived at a point where it not only requires a large amount of thought and capital to properly pave a street, but where it recognizes the economy of maintaining the pavement in good condition.

As each community becomes older it realizes the fact of the presence of a vast number of people who can not properly maintain themselves. The best way to help these is not by charity alone, but by providing such improvements that men with capital will come to the city, erect factories, or otherwise directly or indirectly give work to that large class which generally, through no fault of their own, must remain the servants and minor employes of others.

Cities with disagreeable, repelling streets, improperly paved, noisy and poorly cleaned, can not be successful nor retain successful men—much less draw them to it.

Many a terse statement of the ancient Romans has descended through the centuries. None better than "*Mens sana in corpore sano.*" That a sound mind needs a healthy body is as true of a city as of a man. No man or city can be successful unless in health. Cleanliness is the great preventive of disease—the modern way of combatting disease. Nothing assists a city's health more than streets paved with smooth, impermeable surfaces, which retain no filth and enable that which from time to time comes on the surface to be easily removed.

Men like to be appreciated as well as paid. Due honor is given to Haussmann and Alphand, who rearranged the net-work of streets of Paris and paved them so that they are admired by all. The labors of Colonel Haywood, in London, and Hobrecht and Gottheiner, in Berlin, as well as the engineers who are to-day carrying out the vast attractive street improvements of Washington, New

York and other cities, are fully appreciated and highly honored by the public which sees the results of their work.

The repaving and proper maintenance of the streets of New York under Edward P. North, and their thorough cleaning for the first time by George E. Waring, are matters of national interest and example.

The paving, maintaining and cleaning of city streets are indeed matters calling for the attention of the best brains. These important functions of successful city life should not be left to ignorant, apathetic or untrained men. Such positions of trust, if used for "awards" to mere politicians, amount to robbing the city of much that it has in addition to delaying its ultimate success.

A glance at a city or portion of a city encumbered with narrow, unattractive streets, surfaced with pavements which absorb, breed and disseminate many germs of disease, fatal to human life—a simple glance shows how these things are to be dreaded. In such quarters of a city where the sickly, poor, degraded and crowded tenements stand, there is little inspiration for the inhabitants to strive for more than a mere existence.

In ancient Greece it was the custom for a student or philosopher to write and make public what was known as an *apologia*, which meant a plea for better things. This article is an attempt on my part to write an *apologia* for better paved, repaired and cleaned streets of American cities.

J. W. HOWARD.

JAMES WAITE HOWARD is one of five sons of General O. O. Howard and was born at West Point, N. Y., shortly before the civil war, when his father, then a lieutenant, was stationed there as an instructor in mathematics. He received his early education in private schools and then entered a high school. By the changes of residence usual to an army officer, the father took the son with him from place to place. After completing his high school course he went to Alaska in 1876, and then to Andover, Mass., where he graduated at Phillips Academy in the classical course. He followed this up by practical work in railroad construction and tunneling on the West Shore railroad. Being on the West Point section he lived with his father, who was again in charge of the military academy, and benefited by attending lectures and taking such lessons at West Point as seemed to be of advantage. He then went to France and finished a course of study there. After visiting several German universities he decided upon a course of higher mathematics and physics at the University of Gottingen, Germany. He then returned to the United States, and after some experience in Nebraska at practical work for the purpose of putting himself more in touch with

American methods of construction, he took a course of study at the Rensselaer Polytechnic Institute at Troy, N. Y., from which he graduated with the degree of civil engineer. He has spent much time abroad in studying municipal engineering and has collected a vast amount of valuable information on the subject, especially on street construction and equipment. He is a civil engineer with offices in New York City. He is a member of several scientific societies and is a major in the national guard of New Jersey. He has been a frequent contributor to PAVING AND MUNICIPAL ENGINEERING, and has charge of the question department in this magazine.

FROM COBBLESTONES TO ASPHALT AND BRICK.

By N. P. Lewis, M. Am. Soc. C. E., and Engineer of Street Construction and Maintenance in the City of Brooklyn.*

IT will be conceded that there is nothing which goes further to make a city attractive as a place of residence, to foster a healthy public spirit and municipal pride, and to educate the people in habits of cleanliness and in respect for the laws of sanitation, than well paved streets. To the observant visitor, the city of Brooklyn must present a most incongruous appearance, with block after block of beautiful houses, some with spacious grounds, fronting upon rough cobblestone pavements, such as can scarcely be found in any other city in this country.

At the close of the year 1879, of the 335.7 miles of paved streets in Brooklyn, 292.9 miles or 87.25 per cent. were cobblestone, while 5.12 per cent. were trap rock, 4.95 per cent. granite and 2.13 per cent. bituminous concrete, with a small amount of Nicholson wooden block and macadam or gravel roadway. Meanwhile the work of cobblestone paving was going on, and during the years 1879 to 1887 inclusive, more than twenty miles of this kind of pavement were laid.

In 1888 the commissioner made the following vigorous protest:

It is a false economy which dictates the laying of a cobblestone pavement in any part of the city, and I believe that so far from its improving the value of adjoining property, the true interests of the owners would be better subserved by leaving the roadbed unpaved until such time as a granite block pavement could be laid. * * If the damage done to horses and vehicles in the city of Brooklyn in any year by the rough and uneven cobblestone pavement could be computed, the sum would be something startling, to say nothing of the discomfort caused those obliged to ride over them, and the frequent accidents which

*This article is condensed by Mr. Lewis, specially for PAVING AND MUNICIPAL ENGINEERING from his official report to the chief engineer of Brooklyn.

occur on account thereof. * * It is safe to say that the sum total of expense and damage caused by the vile cobblestone pavement to animals and vehicles in the city is, in each year, greater than the interest charge would be on an amount sufficient to pave every thoroughfare in the city of Brooklyn with a substantial granite block pavement.

These appeals seem at last to have been heeded, for during the next year 21.7 miles of cobblestone pavement were replaced with granite, and a quarter of a mile covered with asphalt, although 6.3 miles of new cobblestone were laid, making the net decrease of cobblestone 15.65 miles. In 1890, again 14.15 miles of granite, 0.83 miles of asphalt and 0.34 miles of Belgian were substituted for cobble, while 6.03 miles of the last named pavement were added, decreasing the cobblestone mileage by 9.29 miles. In 1891, cobble more than held its own, 6.44 miles giving way to granite and 0.39 miles to asphalt, while new work done made the total 0.628 miles more.

In 1894 granite was substituted for 3.16 miles and asphalt was laid over 2.57 miles of old cobblestone streets, but the net result of the year's work was a gain of 0.185 mile of cobble. There was taken, however, a long step forward in the movement for better pavements, viz.: the proceedings begun in the common council for new pavements almost uniformly called for granite or Belgian blocks.

During the year 1895 the paving done resulted in an increase of 10.09 miles of granite and 8.72 miles of asphalt, while the mileage of cobblestone has been decreased 14.66 miles and that of Belgian 0.7 miles. Our first pavement of vitrified brick has been laid during the last year, amounting to 0.32 miles.

It will be noticed that the pleas annually put forward by the department of city works for better pavements urged almost exclusively the repaving of business streets with granite blocks, and almost wholly on the score of economy. Very little was said about smooth, quiet pavements for residence streets.

The character of pavement usually laid at present in the principal cities of the country, according to information furnished me by municipal engineers, is as follows:

New York—Granite, asphalt or trap rock.
Chicago—Cedar block or macadam.
Philadelphia—Granite, asphalt or brick since 1885.
Brooklyn—Cobblestone or trap rock.
St. Louis—Granite, asphalt or wood block.

Boston—Macadam, granite or asphalt.
Baltimore—Cobblestone.
Cincinnati—Granite, asphalt, brick or cobblestone.
Buffalo—Asphalt on 6-inch concrete.
New Orleans—Asphalt, brick or gravel.
Washington—Asphalt, granite or macadam.
Detroit—Asphalt, brick or cedar block on concrete.
Milwaukee—Cedar block.
Newark—Granite, trap or asphalt.
Minneapolis—Cedar Block.
Louisville—Granite, brick or asphalt.
Omaha—Asphalt, brick or sandstone.
Rochester—Asphalt, brick or macadam.

It will be seen that the people of Brooklyn stand almost alone in their willingness to not only tolerate the wretched cobblestone pavements, but to insist upon their further extension. In all the cities mentioned above, the entire cost of the first improvement is assessed upon the property benefited, with the exception of Boston and Washington, while in many of them the cost of a repavement is also paid entirely by the property owners.

It is astonishing to see not only the indifference but the positive hostility manifested by many citizens of Brooklyn when it is proposed to assess them for one-half the cost of substituting asphalt or vitrified brick for cobblestone. I quote the following from a protest recently presented to the common council against the repaving with asphalt of one of the most attractive of our short residence streets:

September 30, 1895.

The undersigned, property owners on ——— in the city of Brooklyn, do hereby protest against the laying of an asphalt pavement in said street, to take the place of the present pavement, for the reason that it will reduce the value of property from twenty-five to thirty-five per cent. on its present market value.

We also protest because it will make ——— a thoroughfare from ——— to ——— for carts and vehicles of all kinds, including bicycles, and also for roller skates, and the resulting noise will be so intolerable that it will make the street undesirable for private residences. * * *

Inasmuch as ——— is only three blocks long and is solely used for private residences, there being not a store or a shop on the street, we appeal to you to save our homes from discomfort and our property from being sacrificed, and also from being taxed for something we do not want and do not need.

Other extracts from these protests are as follows:

"The street at present is good enough."

"The lives of our children would be in constant danger from reckless riders and drivers, if this private street is to be made a thoroughfare."

"It seems to be a ridiculous waste of money to pave one short block (255 feet) on a railroad street with an untried pavement called 'vitrified brick.'"

"We would prefer the privacy of the street as a residential street, and for the safety of our children who would not be menaced by additional travel of bicycles and other vehicles."

The amount assessed upon each frontage of twenty feet for repaving a cobblestone street with asphalt on a concrete foundation, has been, during the past year from $36 for a roadway twenty-four feet wide to about $50 for a forty-two foot carriageway, while the value of the property affected is certainly enhanced by a much greater sum. A case brought to my attention the past season was of a single block on the Park slope. Before the cobblestones were replaced with asphalt a considerable number of the houses were vacant. Within a fortnight after the new pavement was completed every house was taken. This incident did not occur during the ordinary "renting" season.

A comparison of the policy of Brooklyn with that of other cities will certainly show that the city is dealing very generously with the property owners in the movement for better streets.

The following table shows the relative mileage of the different kinds of pavements in this and other cities and will be interesting:

A TABLE SHOWING MILEAGE OF PAVED STREETS AND PERCENTAGE OF VARIOUS KINDS OF PAVEMENTS IN THE PRINCIPAL CITIES OF THE UNITED STATES.

City.	Total Mileage of Paved Streets.	Percentages.							
		Granite and Sandst'ne	Trap Rock	Asphalt	Vitrified Brick	Cedar Blocks	Cobble-stone	McAdam or Telford	Gravel
New York	386.99	47.61	30.17	16.34	.....	.....	0.15	5.73	.....
Chicago	1,085.13	2.35	.....	2.63	0.12	64.98	.....	29.92	.....
Philadelphia	796.65	35.72	.....	19.14	7.31	.....	20.61	17.22	.....
Brooklyn	443.26	21.81	9.33	3.94	.....	.....	64.43	0.49	.....
St. Louis	354.89	12.93	.....	2.54	.....	.....	.....	84.53	.....
Boston	438.39	17.97	.....	1.51	0.10	.....	0.72	50.16	29.45
Baltimore	329.50	9.71	.....	3.94	0.15	.....	84.98	1.21	.....
San Francisco	146.00	.....	45.00	*45.00	.....	.....	10.00	.....	.....
Cincinnati	293.00	15.36	.....	6.14	8.53	.....	27.30	42.66	.....
Buffalo	317.00	37.54	.....	60.88	1.26	.....	.....	0.31	.....
New Orleans	85.00	34.12	1.18	10.57	1.18	.....	45.88	†7.06	.....
Washington	164.15	17.42	.....	66.62	0 12	.....	8.82	7.01	.....
Detroit	225.68	0.78	.....	7.98	5.76	80.25	0.50	4.74	.....
Milwaukee	285.63	3.85	.....	1.58	0.05	17.50	.....	.....	77.02
Newark	65.05	29.61	15.37	6.43	.....	.....	31.78	16.82	.....
Minneapolis	94.60	10.39	.....	3.58	.....	86.03	.....	.....	.....
Louisville	151.00	13.38	.....	4.04	11 92	.....	6.75	63.90	.....
Omaha	78.12	31.62	.....	26.48	13.68	28.22	.....	.....	.....
Rochester	100.26	26.61	.....	24.35	3.52	0.73	0.72	24.27	19.81

*Bituminous rock. †Shell.

The following table will show the prevailing prices for the various kinds of pavements in different cities. Some of the figures may be misleading, as I could not ascertain the class of work or character of foundation in all cases:

TABLE SHOWING THE COST PER SQUARE YARD OF PAVEMENTS OF VARIOUS KINDS IN DIFFERENT CITIES.

City.	Granite Block.	Asphalt.	Vitrified Brick.	Cedar Block.	Cobble-stone.	Macadam.	Year
New York	*$3.00					$1.60	1895
	2.25	$2.97	.....	.....	.....		
Chicago	2.84	1.82	.....	$0.79	.....	.70	1894
Philadelphia	3.48	2.50	$2.05	.....	.....	1.45	1895
Brooklyn	1.89	1.97	2.26	.....	$0.36	1.13	1895
St. Louis	3.00	2.70	1.45	.....	.....	.70	1895
Boston	*4.75						
	†3.50	3.75	.....	.....	.....	.....	1894
	3.00						
Baltimore	2.60	2.70	2.50	.....	.60	.....	1895
Cincinnati	*4.25	2.80	1.80	.....	1.70	1.25	1895
Buffalo	§3.50	3.00	2.75	.....	.....	2.00	1895
New Orleans	4.50	3.50	3.00	.....	2.50	‖1.10	1895
Washington	.....	2.10	.....	.....	.....	1.00	1894
Detroit	‡3.30	2.50	1.50	‡1.10	.90	.....	1895
Milwaukee	2.32	2.17	1.40	1.00	.....	.....	1895
Newark	‡2.96						
	2.08	2.70	2.22	.....	.....	.....	1895
Minneapolis	2.48	2.49	1.90	.....	.....	.75	1895
Louisville	2.55	3.00	1.50	.....	1.40	1.10	1895
Omaha	2.50	2.98	1.75	.....	.....	.....	1895
Rochester	.....	2.50	1.90	‡2.65	.80	.80	1895

*On concrete, pitch joints. †On gravel, pitch joints. ‡On concrete, gravel joints. §Medina sandstone. ‖Shell.

I have also prepared a table showing the average amount expended per capita per annum in certain cities, which is given below, the population having been taken from the census of 1890, which was about the middle of the period for which most of the averages were taken:

TABLE SHOWING THE RECENT AVERAGE EXPENDITURE—TOTAL AND PER CAPITA—FOR STREET PAVEMENTS IN VARIOUS CITIES.

City.	Population in 1890.	Assessed upon property benefited.	Per capita.	Paid by city at large.	Per capita.	Total average expenditure.	Per capita.	Miles of improved streets per each 1,000 of population.		
New York	1,515,301	$ 469,332	$0.31	$839,177	$0.55	$1,308,509	$0.86	0.25	Aver. of	10 yrs.
Brooklyn	806,343	263,947	0.327	429,583	0.533	693,531	0.86	0.55		
St. Louis	451,770	410,596	0.91	30,084	0.07	440,680	0.98	0.78	Aver. of	10 yrs.
Baltimore	434,439	no rec	ord	371,429	0.85	.....	.....	0.76	"	7 "
Cincinnati	296,309	614,919	2.08	394,573	1.33	1,009,492	3.41	0.99	"	10 "
Buffalo	255,664	1,186,267	4.64	none	.....	1,186,267	4.64	1.24	"	10 "
Washington	230,392	none	.....	379,771	1.65	379,771	1.65	1.06	"	12 "
Detroit	205,669	400,916	1.95	248,442	1.21	649,358	3.16	1.10	"	5 "
Milwaukee	204,150	no sepa	rate	record	.....	184,325	0.90	1.40	"	10 "
Newark	181,518	223,381	1.23	74,240	0.41	297,621	1.64	0.36	"	2 "
Minneapolis	164,738	110,564	0.67	27,600	0.17	138,164	0.84	....	"	10 "
Omaha	140,452	301,366	2.15	68,180	0.48	369,546	2.63	....	"	12 "
Rochester	133,896	no sepa	rate	record	.....	325,978	2.43	0.75	"	8 "

Here Brooklyn, the fourth city in population, is shown to have expended a total of eighty-six cents per capita per annum, while Buffalo, which ranked at that time eleventh, has expended $4.64, and Detroit, fifteenth in rank, has paid $3.16 per capita per annum upon street pavements. While the average expenditure in New York and Brooklyn has been the same, it must be noted that the latter has more than double the improved street mileage of New York in proportion to population, while New York has nothing but what in Brooklyn would be called improved pavements.

The facts cited show that Brooklyn's pavements have been and undoubtedly are the worst to be found in any large city of the country; that Brooklyn has spent less money upon her streets in proportion to her population than any other city; that many of the people of Brooklyn seem satisfied with pavements such as the residents of no other city will tolerate, and that they frequently protest against the improvement of their streets as entirely unnecessary; while they are having pavements laid for lower prices than those for which the same work is being done in any other city. These may be unpleasant facts, but it is necessary that they should be realized in order that the progress which has been made during the last year may be continued. We have still 269.7 miles of cobblestone streets.

An erroneous impression I think very generally prevails as to the relative economy of the different kinds of pavements. The average cost of those laid in Brooklyn during the last year, including curbing, cross-walks, inspection, etc., has been as follows:

Granite blocks laid on sand	$2.67 per sq. yd.
Belgian blocks laid on sand	1.68 "
Asphalt on 6-inch concrete	2.50 "
Asphalt on 4-inch concrete	2.17 "
Asphalt over cobblestone	1.96 "
Vitrified brick on 5-inch concrete	2.55 "

The life of the granite or Belgian pavement, on streets having a light or moderate traffic, will probably be forty years, but with the frequent opening by gas and electric companies and for private repairs and connections, the surface is invariably so bad after half that period that a relaying of the pavement is required, which, with recutting of blocks and substitution of new ones where required,

will cost about one dollar per square yard. This means a total expense of about $3.67 in forty years, or including first cost, 9.1 cents per square yard a year for granite pavement. Asphalt pavements are laid under a guarantee for five years. The average amount expended for repairs upon our asphalt streets after expiration of the guarantee, excepting certain streets, has been 3.84 cents per square yard per annum. In Buffalo, during the year 1894, it was 5.1 cents, and in Washington 2.9 cents per square yard. In my judgment the work done by the contractors, owing to their increasing experience in the manipulation of the materials, is constantly improving, and this, added to the fact that as the mileage of improved streets increases, the travel upon them will be distributed and become lighter, justifies the prediction that the cost of repairs in the future will be materially less than it has been, say three cents per square yard per annum. Assuming a first cost of $2.35 for asphalt on a five-inch concrete foundation, and that at the end of eighteen years the street must be resurfaced with asphalt at a cost of $1.10 per square yard, the total cost of the pavement for thirty-six years will be about $4.23 or 11.7 cents per square yard per annum; or if laid over cobblestone, at a first cost of $1.96 per square yard, the total cost for the same period would be $3.84 or 10.7 cents per square yard per annum. Will not the beauty, quiet and comfort of the asphalt street be worth far more than the difference in cost, to say nothing of the economy in traction and the lessened damage to horses and vehicles? What I have said with respect to asphalt will, I think, prove equally true as to vitrified brick.

Of course I would not advocate the laying of an asphalt or vitrified brick pavement upon any street where the traffic is very heavy, but there is a certain point where granite ceases to be, and a smooth pavement becomes economical. I have begun a series of observations involving a census of street travel, which, in connection with the cost of repairs upon asphalt streets, will furnish some valuable data to aid in establishing this point, but they have not yet been carried far enough to be of any value.

Asphalt blocks, I think, will be found peculiarly well adapted to many of the railroad streets where the vehicular traffic is not heavy enough to require the use of granite.

A strenuous effort has been made to compel the street railway companies in Brooklyn to bring their tracks to conform with the proper grade of the streets which were repaved, and where it could be done without injury to buildings and sidewalks, slight modifications have been made in order that the unsightly and often dangerous side slopes, so frequently found upon railroad streets, might be avoided. I believe that no railroad construction or reconstruction should be permitted in any street having an improved pavement, or upon which such a pavement is about to be laid, unless it is done in the most substantial manner, the ties being placed upon and embedded in concrete or broken stone, which should be carried up to the sub-grade of the pavement and a grooved rail used.

The specifications for asphalt paving in Brooklyn were modified so as to admit any material which would produce a paving mixture similar in its essential features to the standard described, which is made from Trinidad Pitch Lake asphalt. I quote the section describing the general requirements:

"(14) Whatever may be the character of the asphalt used, or the manner of manipulation and laying, the pavement obtained must be the same or equal to that resulting from the use of the standard mixture described in section 11, and shall conform to the following general requirements: The pavement when laid shall not be so soft as to be unfit for travel on the hottest days of summer, nor so hard as to disintegrate from the effects of frost. When laid it shall be equal in consistency, surface, durability and other properties to the standard pavement made as hereinbefore described. It shall yield, when extracted with bisulphide of carbon, and after evaporation of the solvent, not less than seven and a half (7½) nor more than twelve (12) per cent. of substance, which shall have the same properties as the substance extracted in the same way from the above mentioned pavement made from Trinidad Pitch Lake asphalt, heavy petroleum, residuum and mineral matter in accordance with the foregoing specification, or properties which shall be considered as equivalent or superior thereto by the commissioner of city works. It shall have a fire test of 300° Fahrenheit, and shall contain no water nor any appreciable amount of light oils and matter volatile at temperature under 250° Fahrenheit. It shall not possess any marked acidity to caustic potash. The mineral matter which it contains shall be the same or equivalent in nature and condition to that prescribed in the preparation of the standard pavement hereinbefore described, except in the case of the use of rock asphalt when the mineral matter shall be that which occurs in the natural product."

Some of the pavements laid under this specification may, per-

haps, be considered as experimental, at least in this part of the country, and under our climatic conditions.

Too much importance can not be attached to the careful collection of data relative to the annual expense and ultimate life of improved pavements. The policy of making repairs to asphalt streets only when they become absolutely necessary, or even by the year, is in my judgment an unsatisfactory one. Contracts for such repairs should be made for a term of at least three years. The contractor will then watch the pavements closely and will not allow them to fall into bad condition.

One of the most difficult problems in connection with the maintenance of streets is the proper control of the opening of the pavements, especially when newly laid, for the purpose of making connections with or repairs to the various sub-surface pipes, conduits, etc. It rarely happens that a new pavement has been completed a month before it is cut into by some corporation or plumber. This frequently occurs at one end of the street before the contractor has left the other end. Circumstances arise, however, when it becomes necessary for plumbers to make openings for private connections or repairs, and permission can not well be refused. The great difficulty in such cases is to secure a proper refilling of the trenches. The most careful inspection, while it may lessen the danger of settlement, can not prevent it. The person or corporation making the opening must be made to realize that any carelessness in refilling will be a serious matter of expense to him or them. The most effective way to insure good work will be, I think, to issue no permit for openings except upon condition that the party taking it out shall agree to become permanently responsible for a settlement of the paving after it shall have been restored, and that if at any time afterwards a settlement shall occur, the city may order it repaired and the cost thereof shall be paid to the city before any more permits are issued to him or them. This will not dispense with inspection, but would be an additional precaution. The sum charged for permits should be sufficient to pay for thorough inspection as well as repaving. All cities seem to be struggling with this problem and none appear to have satisfactorily solved it.

NELSON P. LEWIS is one of the most capable and progressive municipal engineers in America. His professional services in this kind of work have been rendered largely in connection with the department of city works of Brooklyn, beginning about a dozen years ago. His connection with the department, however, has not been continuous. After a successful civil service examination he was employed by the department in 1884 and was assigned to work on the aqueduct extension. He became dissatisfied after two years on account of the slow progress of the work and resigned. He located at Birmingham, Ala., and assisted in the building of a railroad. He was afterward engaged for a time in engineering work in Savannah. In 1889, Mr. Van Brunt Bergen, the chief engineer of Brooklyn, asked him to return to that city and resume his connection with the department of city works. He accepted the position offered him and was given charge of various important engineering projects. Two years ago Commissioner White put him in charge of the bureau of local improvements. His services in this position have been very valuable to the city. A month ago his powers were enlarged and he was made engineer of street construction and maintenance, with an increase of salary. Mr. Lewis is a member of the American Society of Civil Engineers, and is a graduate of the Rensselaer Polytechnic Institute.

A MOVEMENT FOR BEAUTIFYING CITIES.

By Maj. Charles Thruston Greene.

As so much has been done by the village improvement associations in making beautiful villages, why can not we have associations for improving cities? Oh! for a Dr. Northrup who has done so much for New England villages. Who will do the same for our cities?

To accomplish anything we will have to educate the people by lectures, printed matter, articles in magazines, newspapers and pamphlets. No magazine can better lead in this matter than PAVING AND MUNICIPAL ENGINEERING.

In New York and Brooklyn, I would call the organization the Metropolitan Improvement Association, and have it take in "Greater New York." I would have the dues $1.00 per quarter, and include in the membership men, women and children. In New York I would begin by extending several avenues southward until they reached the water edge, and have them as wide as possible. It would be well to provide railroad tracks, and several avenues, and arrange the sewers, gas-pipes and electric wires in the tunnel so that the pavements would never be disturbed. On top of the tunnel a park

similar to Park avenue would be well at many places. At half mile intervals, south of Fourteenth street, there should be a wide street from East river to North river. By opening Seventh avenue down to Canal street much of the traffic which now crowds Eighth avenue would be diverted to it, and the congestion of travel on Eighth avenue would be done away with. By putting four tracks under ground, two for express trains and two for way trains, we could have underground trolley electric cars, trolley cars could be used on very wide avenues up town with the poles put between the tracks as they are in One Hundred and Thirty-fifth street.

In such an organization as is suggested there ought to be a very large membership which could help get the necessary legislation to pay part of the cost of the lasting improvements desired. The cost could not exceed $120,000,000, less than Paris has expended in doing practically the same thing.

Will it pay? These avenues and streets would pass through and destroy a great many old houses two and one-half stories high. A party of capitalists could be formed who would buy the materials of the buildings in the way of the improvements, and who could erect modern flat houses in the resident part, and modern stores in the business part. That these would pay well on the investment there is no doubt. It is said that the tenement houses on the East side pay more rent per square foot for the ground covered than property on Fifth avenue. If any one doubts this let him inquire what rents the people pay on the East side and he will be surprised.

The daily papers report that Mr. Mills, the millionaire of Wall street, is going to put up a model tenement house on the site of the late A. T. Stewart's residence in Bleecker street. This street is ill adapted for such a building, because it is a very narrow street, has a very narrow sidewalk, and has horse-car tracks in it. In an ordinary flat house, twenty-five feet front, five stories high there are ten families. If each family has only three children (and many have more), there are thirty children. It is presumed that Mr. Mills' house will be at least 100 feet front. Calculating that the accommodations will be as above, there will be 120 children. The children will have to play in the street part of every pleasant day. Just for a moment imagine 120 children playing on the narrow sidewalk of Bleecker street. If such a house was built on one of the proposed avenues with the pavement 100 feet wide, fifteen feet

sidewalks, and five feet stoop lines, they would all have room to play—children must play.

To the readers of this magazine, outside of New York, this article may seem of no interest, but the same principle applies to all the older cities. Boston and Providence can adopt ideas at which I only hint. The new cities need such improvement societies. Let there be an improvement society in every city.

CHARLES THRUSTON GREENE was born in 1842 at Brookside, Md., the son of Maj.-Gen. George S. Greene, retired. The record of his father during the civil war is the more remarkable because of his advanced age at that time. He is now ninety-five years old and in good health. Major Greene, now fifty-four years old, began his career in the office of Hallett, Dow & Youngs, New York City, in 1857. His first military experience was in Company G, 22d Regiment, N. Y., as a private, when it went to the front in 1862. Promoted within a few months to second lieutenant, 60th Regiment, N. Y. Volunteers, he served as aid-de-camp on the division staff of his father. The year following, for bravery in battle, he was promoted to first lieutenant. This battle was Gettysburg, where General Greene made the lasting record of holding the right wing with a few troops by timely maneuvers against great odds. Major Greene became assistant adjutant-general Third Brigade, Second Division, 12th Corps, in September, 1863. Leading the brigade at Ringgold, Ga., the cannon ball which killed his horse completely severed the major's right leg. The loss of this leg, while a great inconvenience throughout life, is a mark of service superior to the decorations which he also possesses. For services in this battle he was breveted major, which title he bears. He left the volunteer service in 1865. In July, 1866, he was made captain of Company H, 42d United States Infantry, being at that time only twenty-four years of age and probably the youngest captain ever in the regular army. He went on the retired list December 15, 1870. Since his retirement he has lived in or near New York, giving his time to matters connected with the improvement of streets. In 1893 he identified himself with the movement to improve cities and towns, by organizing and becoming president of the Improvement Society of Brookfield, Conn., where he has a summer residence. This village is already reaping the benefits of better improvements, and a beginning has been made for other things which make life pleasanter.

THE USE OF ACETONE IN THE TECHNICAL ANALYSIS OF ASPHALTUM.

*By Prof. S. F. Peckham.**

DURING the month of January, 1894, while in Southern California, I had occasion, at the request of lawyers who had charge

*Read before the stated meeting of the Franklin Institute, January 21, 1896.

of several applications for patents then on file in the patent office, to seek to distinguish certain residues from the distillation of California petroleum by the use of solvents. A large number were used, and their comparative energy as solvents noted and estimated when applied to the different residues. Among other fluids used were acetone and the most volatile distillates from both eastern and California petroleums, together with a number of alcohols, etc. The great differences observed in the solubility of the same residuum in these different menstrua led to the use of these different solvents as a means of distinguishing the different residues from one another as different chemical substances, for the reason that Dr. Salathé and myself, who were associated in the work, both believed that solution is in every case a more or less marked example of the action of chemical energy, and is, therefore, properly to be considered a chemical reaction, and an index of chemical properties.

It is, therefore, with no little surprise that I note in the journal of the Franklin Institute a paper by Dr. S. P. Sadtler, in which he advocates the use of acetone as a substitute for petroleum ether in the technical analysis of asphaltum. It is true that my experience had been gained from an examination of artificial residues from natural petroleums, in some instances still further removed from the natural bitumens by further treatment, and it was properly to be inferred that additional testimony should be obtained relative to the comparative solvent action of acetone and petroleum ether upon natural bitumens, before any final conclusions were to be reached relative to the use of acetone as such a substitute. In addition to this consideration is the equally important inquiry concerning the purpose of a technical analysis of asphaltum, and the proper interpretation of the results as heretofore obtained.

It is true, a great degree of indefiniteness has hovered around the use of the word "petrolene," and, especially, as regards the ultimate composition of the thing itself; but, after the results that have lately been obtained have been properly considered, it can not be said that the portion of asphaltum soluble in petroleum ether, when ascertained by a careful and skillful manipulator, has any vague significance as a factor in the determination of the relation solid bitumens bear to each other. Not only when applied to different specimens of the same asphaltum, but also when applied to different asphaltums, do the varying proportions of the "petroleum

ether soluble" become an indication of varying chemical properties and relations that further investigation respecting ultimate composition will doubtless render more definite, but from which technology need scarcely expect to receive any striking benefit. Moreover, in view of the fact that a large number of determinations are now on record, in which the solvent power of petroleum ether is a fundamental factor, it is quite necessary that, in the selection of any new solvent, an approximate equivalent for petroleum ether should be found; otherwise, both loss and confusion will follow inevitably.

The only object to be sought by a technical analysis of asphaltum is to thereby establish relations along certain lines that are but just beginning to be understood and appreciated. Results lately obtained have given a definiteness and approximate value to such analyses that removes them from the category of mere empirical factors, and places them more nearly in line with those "constants of nature," which are to appear possessed of permanent value.

I was, therefore, led in the light of my former experiences, and also in view of the striking dissimilarity of the results given by Professor Sadtler to any others on record with which I am familiar, to carefully test the use of acetone with petroleum ether in parallel experiments.

Considerably large portions of two samples of pitch, which I had brought from Trinidad, had been dried in my laboratory to a constant weight. One of these specimens (No. 1) was a sample of crude pitch, the other (No. 2) was a sample of Epurée, made on the island. Duplicate and very closely concordant analyses of these samples had been made by the process described by Miss L. A. Linton, in the paper read at the Cleveland meeting of the American Chemical Society. Other portions from the same dried masses of pitch had been weighed for triplicate and quadruplicate analyses, but were not used, as the duplicate analyses were sufficiently concordant. Those weighed portions were used in duplicate to test the comparative solvent power of the acetone, with the following results:

No. 1.

Petroleum ether soluble	33.736	
Boiling spirits turpentine soluble	10.511	52.367 total bitumen.
Chloroform soluble	8.120	
Organic matter not bitumen	10.851	
Inorganic matter	36.729	47.580 non-bituminous material.
	99.937 per cent.	

No 1.

Acetone soluble	28.180	55.185 total bitumen.
Chloroform soluble	27.005	
Organic matter not bitumen	9.835	44.815 non-bituminous material.
Inorganic matter	34.980	
	100.000 per cent.	

No. 2.

Petroleum ether soluble	33.625	51.875 total bitumen.
Boiling spirits turpentine soluble	15.575	
Chloroform soluble	2.675	
Organic matter not bitumen	10.150	48.125 non-bituminous material.
Inorganic matter	37.975	
	100.000 per cent.	

No. 2.

Acetone soluble	26.310	55.48 total bitumen.
Chloroform soluble	29.170	
Organic matter not bitumen	9.600	44.52 non-bituminous matter.
Inorganic matter	34.920	
	100.000 per cent.	

	No. 1.		No. 2.	
	Petroleum Ether.	*Acetone.*	*Petroleum Ether.*	*Acetone.*
Total bitumen	52.367	55.185	51.875	55.480
Non-bitumen	47.580	44.815	48.125	44.520

From these results it was at once manifest that acetone dissolved much less bitumen than petroleum ether, and, in addition, more than as much more of organic matter not bitumen, and mineral matter. They were also in line with the results given in illustration of his method by Professor Sadtler. In general, Professor Sadtler's results parallel my own, being very low in organic matter not bitumen, and in mineral matter.

To further test this matter, an acetone solution of pitch was prepared and evaporated to dryness at about 60° C. It yielded an organic residuum and deliquescent salt. The salt dissolved away from the bituminous and very viscous residue, and yielded, when evaporated to dryness, an organic residuum soluble in water. A portion of crude Trinidad pitch, exhausted with petroleum ether and chloroform, yielded to acetone a residue, a part of which was soluble in water, a part in sodium hydrate and a part in benzole. One gram of sample No. 1, after exhaustion in chloroform, yielde 1.59 per cent. of material to acetone.

To still further test the relation of the two solvents, equal portions of a very dry Egyptian asphaltum were exhausted under identical conditions with petroleum ether and acetone. The results are given below:

	Per Cent.
Petroleum ether soluble	38.03
Acetone soluble	8.68

Also, an Athabasca river maltha was exhausted in the same manner, with the following results:

	Per Cent.
Petroleum ether soluble	73.863
Acetone soluble	24.333

No difference was observed between the solvent power of cold and boiling acetone in either case. The dry Egyptian asphalt and the semi-fluid maltha exhibit the extremes to which any solvent of bitumen is likely to be applied, and the lack of parallelism is enormously large in both cases.

It appears to me that these results are conclusive, that acetone can not be made an equivalent for petroleum ether in the technical analysis of asphaltum; first, because its solvent properties are unlike those of petroleum ether when applied to pure bitumen; and second, because it dissolves from a complex mineral, like Trinidad pitch, constituents that are not bitumen, thus defeating the very object of the work itself. According to my own observations, the action of acetone upon bitumens more closely approximates that of the alcohols than that of the true solvents of bitumen. If, therefore, acetone is to be used in the technical analysis of asphaltum, a new series of constants will, of necessity, have to be established, which in my judgment would lead only to confusion.

PROF. S. F. PECKHAM.

ASPHALT PAVING IN DIFFERENT CITIES.

LETTERS of inquiries were sent out recently to a number of cities by F. W. Cappelen, city engineer of Minneapolis, asking for information regarding asphalt pavements. Of the number of letters sent out 17 answers were received. A table embracing the points of information was prepared by Mr. Cappelen, which is herewith reproduced:

Notes on Asphalt Paving in Different Cities.

Name of City.	Thickness of Concrete	Thickness of Asphalt Surface	Binder Coat	Cushion Coat	Kind of Asphalt admitted under Specifications.	Is ground included in price	Is removal of old pavement included in price	Guaranty	Bond	Cash Retained	Average price of Concrete per sq. yd.	Average price of Concrete per cu. yd.	Average Price Complete Pavement 1894	Average Price Complete Pavement 1895
Peoria Ills	6"	2"	1½"	½"	Bermudez Trinidad Pitch Lake	Yes	Yes	5 Years	25% of Contract	10% for 6 mos 10% of this 1 year bond meanwhile	160		185	197
Milwaukee Wis	6"&7"	2"	1"	½"	Bermudez Trinidad Pitch Lake	Yes	Yes	5 Years	Total am't of Contract with Surety Bond	10%	125	Not American Cement 4.50		191 to 2.06
Omaha Neb	6"	"	2½"	"	All Kinds	Yes	Yes	5 Years	Personal in double am't of contract	15%	175	Not American Cement 4.00	2.50 to 3.00	2.07
Boston Mass	6"	2½" 2" Trin.	1½"		Sicilian Rock Trinidad	Done by the City	Done by the City	5 Years	By Contract	5% for 6 mos		Not American Cement 4.50	2.25	2.35
St Paul Minn	6"	2"	1"	1½"	Trinidad Pitch Lake Bermudez	yes	yes	10 Years	None	15%	125	Not American Cement		2.21
Philadelphia Pa	6"	Specified by Contractor			Trinidad Pitch Lake Bermudez Sicilian Rock Alcatraz Cal	Yes	Yes	3 Years	½ of Contract	None			2.25 2.45 2.40 2.00	2.25 2.29 2.25 2.25
Rochester N Y	6"	2"	None	None	Trinidad Pitch Lake Sicilian Rock	yes	yes	5 Years	10%	None		Not Am Hyd Cement	2.00 to 2.60	
Detroit Mich	6"	2"	1"	½"	Trinidad Pitch Lake Bermudez			5 Years						2.40
Binghamton N Y	6"	2"		½"	Trinidad Pitch Lake	Yes	Yes	5 Years	½ of Contract	10%		Not American 4.00		2.65
Cleveland O	6"	2"	1"	½"	Trinidad Pitch Lake	Yes	Yes	10 Years	Bond	10%		3.24		2.27 to 2.85
Cincinnati O	6"	2"		½	Trinidad Pitch Lake Bermudez	Yes	Yes	5 Years	25%	10%		3.00		2.75
Kansas City Mo	4"	1½"	1½"		Trinidad Pitch Lake	Yes	Yes	5 years	20%	None	1.00	Not Cement		2.50
	6"	2"	1½"		" "	"	"	5 "	20%	None	1.00	"		2.80
Toronto Ont	4"	1½"		½"	Trinidad Pitch Lake	Yes	Yes	5 Years	30%	15%	1.40	5.00		1.80
	6	2"		½"	" "	"	"	5 "	30%	15%				2.90
Newark N J	6"	2"	1½"											2.70
Buffalo N Y	6"	2"	1½"		Trinidad Pitch Lake Trinidad & German mixed German Rock mixed With Asphaltic	Yes	Yes	5 Years	33%	None	1.00 to 1.25			3.00
New York City	6"	2½	1"		Rock Asphalt Trinidad Overflow Bermudez Alcatraz Cal	Yes		5 Years	& Surety Bond					2.94 to 3.35
		2"						15 years	2 "	30%				
Montreal Can	6	2"			Sicilian Rock Asph	Yes	Yes	5 Years	None	10%		Portland Cement 6.00		3.60
		2		½	Trinidad Pitch Lake			15 "		to 30%				
Minneapolis	6"	2½"			All kinds admitted under Specifications Utah, Wasatch Lima Rock	Yes	Yes	10 Years	15% Surety Bond	10%	1.40	Not Am Cem 3.60	Contract Reading	2.40
"	6"	2"	1"	½"	Trinidad	"	"	"	"	"	"	"		2.45
Washington D.C.	6	2½"	2" Imp'd Concrete		Trinidad & Bermudez		No	5		10%				2.19
Chicago Ills	6	2	1½	½	Trynal to Trinidad	?	?	5	Bond	20 PERCT per yd	1.35	AC 3.60		2.85

REMARKS.

Peoria—Bids have been received for 1896 at $1.84.
Milwaukee—The cost is $2.34 with 7-in. concrete foundation, brick lining to track and brick gutters.
Omaha—The price of $2.07 is for repaving on old streets, with concrete foundation in place and only an additional sheet of concrete 4½ in. thick, and no grading.
New York—A guarantee of fifteen years is required for all repaving.
Minneapolis—The price of $2.40 is for streets with no car tracks; $2.45 is for streets with car tracks, and includes granite lining to rails.

The information gained by City Engineer Cappelen proved valuable for his purposes in that it showed that the bids for asphalt

paving, which were at that time in the hands of the city council of Minneapolis, were about the average. The bids in question ranged from $2.40 to $2.51 per square yard, and the impression seemed to prevail that the contractors who had submitted bids had asked an unreasonable price.

NEW SPECIFICATIONS FOR BRICK PAVING.

A NEW form of specifications for brick paving has been adopted by the Indianapolis board of public works as follows:

1. Upon the foundation of concrete or broken stone, as specified, will be laid a bed of fine sharp sand, free from loam and vegetable matter, and which will pass through a $\frac{3}{8}$-inch mesh. The layer shall be two (2) inches in thickness when compacted, to serve as a bed for the bricks, which will be laid directly upon and imbedded in it, with close end and side joints.

2. The bricks or blocks must be specially hard burned for street paving, free from flaws, cracks or breaks and equal in all respects to samples for the pavement bid upon to be filed in the office of the board. The dimensions shall not be less than $2\frac{1}{4}$ inches in thickness, by 4 inches in depth, by 8 inches in length. The variations in size of brick furnished must not be more than $\frac{1}{4}$ inch in thickness or depth. If the brick furnished are found to vary more than the specified amount they shall be sorted and properly laid with reference to sizes as directed by the engineer.

3. The kind and size of brick shall be specified in the bid and shown by the samples filed, and the bidder shall also, if required, furnish samples of materials used in their manufacture and analyses of the same and a statement showing the kinds and proportions of material used in making the brick and the manner of making and burning the same. The brick shall be subject to test at any time, and the contractor must furnish the brick selected by the engineer for test without additional compensation.

4. All brick shall be subject to thorough inspection by the engineer and his agents both before and after laying, and all rejected material shall be removed from the street immediately, and deficiencies made good by the contractor, and he shall at all times provide at his own expense a sufficient number of men to assist the engineer and his inspectors in the proper inspection and culling of the bricks.

5. Upon the cushion, when prepared as above specified, the paving bricks are to be laid in the following manner: The pavement is to be constructed with a single layer of brick laid on edge, end to end, in right angle or diagonal courses across the street as the engineer shall direct, except at street intersections, where the courses are to be placed at such angles as the engineer shall direct. The bricks are to be set in straight courses with the body of the bricks close together, sides and ends touching, and breaking joints at least two (2) inches with the bricks in adjoining courses. The contractor may be required to lay every tenth course to a line. They are to be set perpendicular to the grade of the street and to a height of $\frac{1}{4}$ to $\frac{3}{4}$ inch, or such other height as the engineer may direct, above the true grade and crown of the street when finished, to provide for settlement in

pounding and rolling. Nothing but whole brick shall be used, except in starting courses or in making a closure at curbs, catch-basins, rails and street structures, when not less than half bricks may be used in breaking joints, which shall be made tight and close at the ends. Great care shall be taken in breaking and trimming the bricks for this purpose, so as not to check or fracture the part to be used; all joints shall be broken or cut at right angles to top and sides of bricks. The breaking and trimming must be done by experienced men working with proper tools.

6. The paving, when laid as specified, and before the filling of the joints and top dressing is put on, shall be thoroughly rolled three or more times lengthwise of the street with a roller weighing not less than five (5) tons. All parts of the pavement which can not, in the opinion of the engineer, be properly rolled shall be thoroughly rammed three (3) times or more in such manner as the engineer shall direct.

7. All soft, cracked or defective brick found in the pavement at any time before the pavement is accepted, whether devoloped by rolling, ramming or otherwise, shall be removed by the contractor and replaced at his expense.

8. The contractor shall remove all rubbish and thoroughly sweep the street for inspection of grade, surface and material before the joint filling is put on.

9. The joints shall then be filled as nearly as possible from bottom to top with a paving cement or grout as specified in the bid and contract, and according to a formula for composition and consistency of same approved by the board of public works and the engineer. Sand may be used as a filler in alleys when specifically stated in specifications, to be applied as directed by the engineer.

10. When grout is used it must be equal or superior to a grout composed of one part of Portland cement by measure and 1½ parts of fine sand, which will pass through a 3-16 inch mesh. It shall be of such consistency as to run readily into the joints and shall be swept in rapidly. The pavement shall be gone over a sufficient number of times to fill every joint. When the foundation is of broken stone the engineer may require the grout to be put on in two coats, the first coat to be of such proportions as he may direct.

11. When paving cement is used, it must approach as nearly as possible to the condition of being pliable, not brittle in cold weather and so solid in hot weather that there will be no tendency to run out of the joints. It shall be equal or superior in quality to a cement composed of 10 per cent. of refined Trinidad asphalt mixed with 90 per cent. coal-tar paving cement, distilled at a temperature not less than 600 degrees Fahrenheit. The temperature shown on the gauge attached to the cement tank shall show not less than 300 degrees Fahrenheit, while the cement is being applied, and shall show such higher degree as the engineer may direct, if considered necessary by him, on account of weather or character of materials used, to render the cement fluid enough to run into the joints properly. The paving cement shall not be used unless the bricks are thoroughly dry. The cement shall be carefully poured from a vessel having a small spout, so that it will run into the joints directly. This will be insisted upon especially in cool weather. Any excess of cement on the surface shall be broomed off so as to leave as little as possible thereon. Great care must be taken not to disfigure the curb, walks or lawns with material and any damage on this account must be repaired by the contractor. Extra care and material must be taken at the gutters and around catch-basins or other structures, in filling all joints in both paving and

curbing to effectually prevent the leakage of water into the sub-roadway. All joints shall be completely filled to the top before the top dressing is put on.

12. The surface of the pavement, when completed as above, shall be covered with a ½-inch top dressing of clean coarse sand of an approved quality. The sand shall be removed by the contractor in two weeks after the completion of the pavement, or on notification from the engineer.

13. The board of public works reserves the right to change the kind of brick or filling to be used in said pavement, even after the contract has been let; this in case it is found necessary to do so by failure of the contractors to furnish the materials bid upon and mentioned in the contract to be used.

SEWER DISCHARGE AND VELOCITY.

By Albert Wolheim, Assoc. M. Inst. C. E.

CALCULATED by the old formula, such as Eytelwein's, the maximum discharge of a circular sewer would take place when depth of flow=.95 d and the angle ACB=52°. But if the more correct formula of Kutter be employed, which allows for the decrease of the frictional coefficient as the hydraulic mean depth increases, the maximum discharge would take place at .93 d, corresponding to an angle of 60°. It seems strange to an observant mind that to this day unanimity is wanting as to the exact depth at which the maximum discharge does actually occur. It only goes to show how great is the difficulty of conducting sewer gaugings which may be termed exact in the strictest sense of the word, and what a large field still remains open to the experimenter.

The subjoined table will prove useful in comparing the relative proportional values of discharge and velocity if calculated by Eytelwein's and Kutter's formula respectively—*i. e.*, when C remains constant and when it varies. The values by Kutter's are averages for the different sizes of pipes, but the variation due to size of type is comparatively insignificant. The depth is given in terms of the diameter.

The following table gives proportional values of velocity and discharge for circular sewers at different depths of flow:

(Values for *full* pipes are taken as unity.)

	Eytelwein (*c constant*).		*Kutter* (*c variable*).	
Depth.	*Velocity.*	*Discharge.*	*Velocity.*	*Discharge.*
1.00 (full)	1.00	1.00	1.00	1.00
.90	1.09	.99	1.14	1.08
.80	1.10	.94	1.15	.99
.75 (¾ full)	1.09	.88	1.14	.92
.70	1.08	.82	1.12	.84
.60	1.05	.66	1.08	.68
.50 (½ full)	1.00	.50	1.00	.50
.40	.93	.35	.89	.33
.30	.83	.21	.75	.19
.25 (¼ full)	.76	.15	.66	.13
.20	.70	.10	.57	.08
.10	.50	.02	.34	.02

In the foregoing table the velocity and discharge *when flowing full* are taken as unity. But as all formulæ and experiments seem to teach that the maximum discharge and velocity occur when the sewer is flowing not quite full, some have advocated that the points of maximum discharge and velocity should rather be taken as unity, as shown in the table below, based on Kutter's formula, giving proportional value of velocity and discharge for *circular sewers* at different depths of flow.

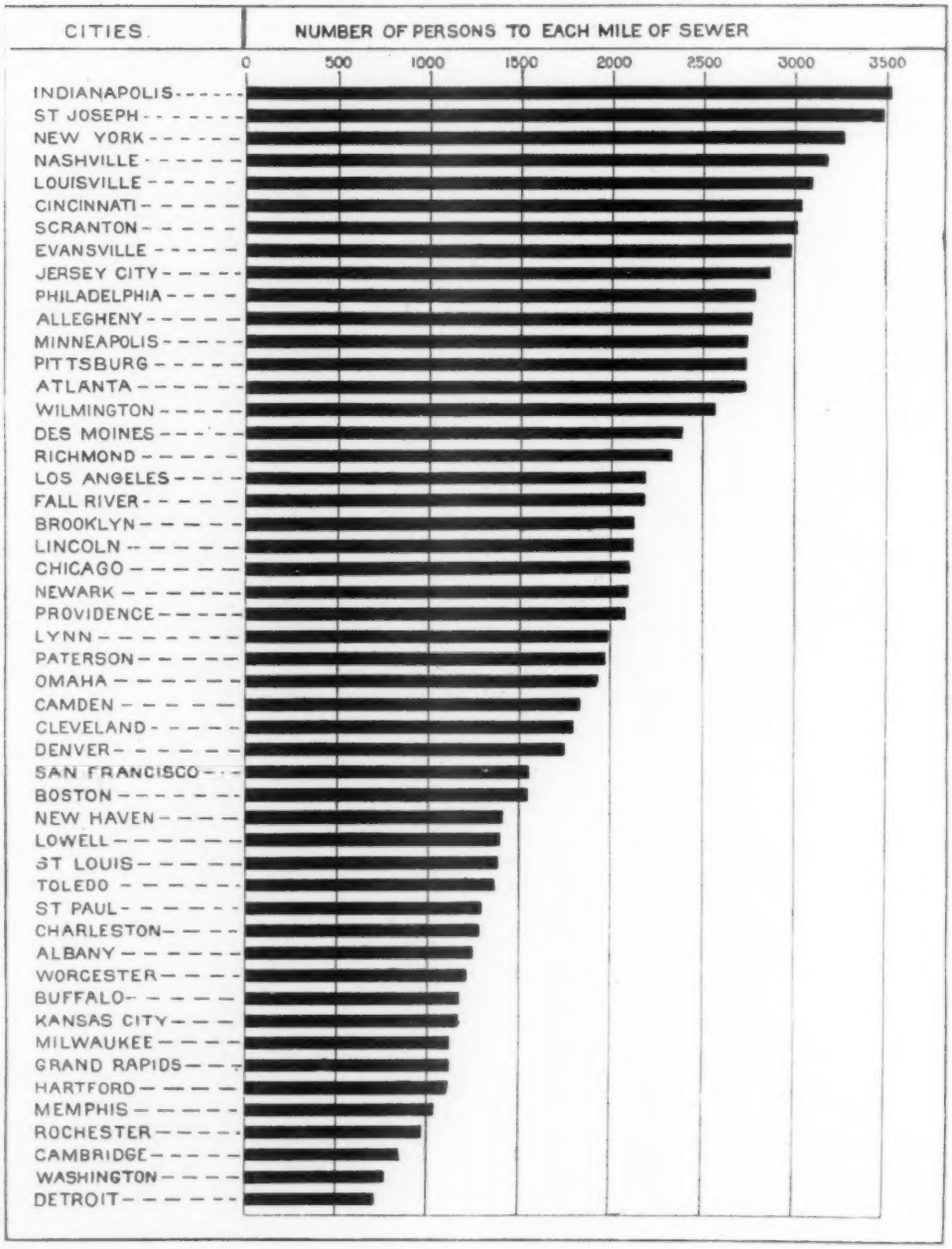
(*Maximum* velocity and discharge are taken as unity.)

Depth.	*Velocity.*	*Discharges.*
1.00 (full)	.86	.916
.93	.96	1.000
.90	.98	.992
.81	1.00	.924
.80	.99	.912
.75 (¾ full)	.99	.850
.70	.98	.776
.60	.93	.620
.50 (½ full)	.86	.450
.40	.76	.302
.30	.64	.168
.25 (¼ full)	.57	.118
.20	.48	.072
.10	.28	.016

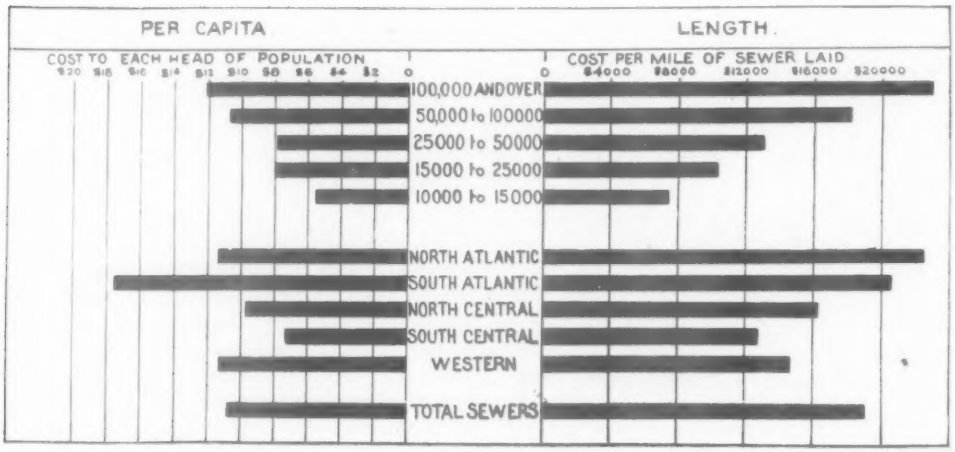
But considering that no sewer ever can run quite full by gravitation alone, and that it be put under pressure to do so, it is more probable that further investigation and experiments will reveal the fact that a sewer running under a head just sufficient to fill it to the crown discharges at least the same quantity as when running at its maximum capacity by gravitation only.

DIAGRAMS OF SEWER STATISTICS.

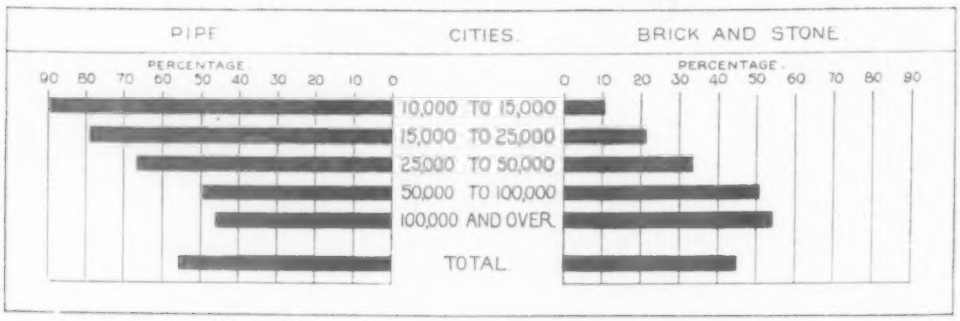
DISTRIBUTION OF THE POPULATION IN RELATION TO SEWERS IN EACH OF THE 50 LARGER CITIES



TOTAL COST OF SEWERS BY POPULATION AND GEOGRAPHICAL GROUPS FOR 182 CITIES



PERCENTAGE OF PIPE AND BRICK AND STONE SEWERS FOR 200 CITIES BY MAGNITUDE OF POPULATION AND FOR TOTAL SEWERS



CEMENT AND ITS USE.

PROPORTIONS OF THE CONSTITUENTS OF CONCRETE.

*By John Watt Sandeman, M. Inst. C. E.**

In proportioning the constituents of concrete, the ratio of cement to sand, and of cement and sand to aggregates, may be varied greatly, and instances are frequently met with where these ratios are so varied without regard to relative strength and economy of the concrete. But there is a simple method by which, with the same ratio of cement to other materials, maximum strength and economy in concrete are attained. It is clear that with similar aggregates the strength of concrete depends upon the strength of the mortar, and the strength of mortar upon the ratio of cement to sand, so that in concrete having the same ratio of cement, that with the smallest ratio of mortar to aggregates will afford the greatest ratio of cement to sand, and will therefore be the strongest. For example, concretes with the same ratio of cement may be made (and sometimes are made) with the other materials varying in the following proportions: No. 1. 1 cement, 2 sand, 5 aggregates; No. 2. 1 cement, 3 sand, 4 aggregates; No. 3. 1 cement, 4 sand, 3 aggregates. Assuming the cost per ton of the sand and aggregates to be the same, the cost per cubic yard of the three concretes would be nearly the same; but as No. 2 would be two-thirds the strength of No. 1, and No. 3 half the strength of No. 1, their relative values should be estimated accordingly. The mode of determining the most economical rates of materials for concrete is as follows:

1. The ratios of interstices of different aggregates are required, and these were ascertained by the author to be as in the following table:

	Weight of Aggregates per Cu. Ft.	Ratio of Interstices
	Lbs.	Pr.Ct
Broken limestone, the greater part of which would be gaged by a 3 in. ring	95	50.9
Gravel, screened free from sand, varying in size between small pebbles and pieces gauged by a 2½ in. ring	111½	33.6
The above limestone and gravel well mixed in equal proportions	113½	33.6
Sandstone varying in size between pieces gauged by a 4 in. ring and pieces gauged by an 8 in. ring	74	50.0
Sandstone varying in size between sand and pieces gauged by a 4 in. ring	92	34.0
The two above sandstones mixed in equal proportions	91¼	36.0

2. The volume of dry cement and sand necessary to produce one volume of water (ranging between 1 cement and 1 sand and 1 cement and 3 sand) was found by the author to average about one-third more than the volume of the mortar when set.

3. An aggregate, therefore, with interstices of 35 per cent., and adding 10 per cent. to insure that each piece of stone or gravel is surrounded with mortar, would give 45 per cent. of mortar, to which one-third, or 15 per cent., is to be added to give the volume of cement and sand, equal to 60 per cent. of the volume of the aggregate; this ratio will give the following volumes of materials as the most eco-

* Extracts from a paper read before the Institution of Civil Engineers.

nomical for ordinary concretes in which water-tightness is not essential:

Cement.	Sand.	Gravel or Broken Stones Varying in Size between the Residue left by 1/8 in. Sieve and that which passes through a 2 in. Sieve.	Ratio of Cement to other Materials.	Ratio of Sand to Gravel.
				P. Ct.
1	1	3.33 say $3\frac{1}{2}$	1 to $4\frac{1}{2}$	28.5
1	$1\frac{1}{2}$	4.16 " $4\frac{3}{4}$	1 to $5\frac{3}{4}$	35.3
1	2	5.0	1 to 7	40.0
1	$2\frac{1}{2}$	5.833 " 6	1 to $8\frac{1}{2}$	42.8
1	3	6.66 " 7	1 to 10	45.0

From a study of the facts adduced in regard to the greater strength and economy attained by duly proportioning the components of concrete, the author strongly deprecates the slovenly and unscientific practice of using in the manufacture of concrete unscreened gravel and sand, as, although in cases where such material is employed the approximate ratio of sand to gravel is sometimes supposed to be ascertained by sifting a few samples, yet this ratio varies so widely, viz., between 19.5 per cent. and 113.6 per cent. that it would be quite impossible to obtain uniformity. Moreover, as the ratio of sand to gravel in the most economical concretes has been shown to range between 28 $\frac{1}{2}$ per cent. and 45 per cent., it is clear that the varying natural rations of sand to gravel would not make economical concrete as even assuming that the ratio of sand in any gravel were exactly according to requirements, it would be immediately ordered by casting the material into wagons or barges. Again, by tipping them onto a heap, the sand and gravel always separates and assort themselves under the influence of gravity, and the author has witnessed the practical impossibility of combining the two again in due proportions when shoveling them out of a heap. Where concrete is made from unscreened gravel there must of necessity be portions of it in which the interstices of the gravel are not filled, and others in which the mortar is in excess, and in consequence the strength of such concrete is very variable.

The strength of concrete depends upon the strength of the mortar, and the strength of mortar upon the ratio of cement to sand, so that it is of vital importance that the cement and sand should first be thoroughly mixed together dry, in order that each grain may have its due share of cement. In hand mixed concrete this can not be accomplished without turning over the cement and sand completely at least three times. After this has been done they should be cast on to the aggregates, and it is then only necessary to turn over the whole once dry. Water should be added while the materials are being again turned over until the water is thoroughly incorporated throughout the mass. This system of first mixing the cement and sand considerably reduces the labor, as it only necessitates the turning over the aggregate once dry, instead of two or three times, as is the general practice; and as the aggregates average more than twice the bulk and weight of the cement and sand, the saving of time and labor is considerable.

In hand mixed concrete, the quantity of water necessary to render one mixing of the proper consistency having been noted, the same quantity of water should be used for each mixing, the uniform consistency of the concrete being of vital importance. The thorough hydration of the cement is also of paramount importance; but as the quantity of water required will vary with the age and quality of the cement, the character of the sand and aggregates, and the state of the

weather, the proper quantity to insure thorough hydration, without washing the cement out of the concrete or causing the aggregates to settle down in contact with each other, can only be determined by the observation of an engineer experienced in the manufacture of concrete. It may be stated as a guide that, when deposited the concrete should be somewhat of the consistency of dough, and should always yield sufficiently to allow of a man treading it to sink into it to a depth of at least six inches. Workmen should always be employed to tread and shovel each mixing of concrete throughout, while it is being deposited, otherwise water-tightness will not be attained. In order to insure this, engineers should require contractors to provide men treading the concrete with water-proof boots. Concrete mixing should not be allowed to proceed during very windy or wet weather, unless performed under sufficient shelter, as a considerable percentage of the finest and most valuable part of the cement will be blown away, and during rain the cement and sand can not be efficiently mixed.

TENSILE STRENGTH IN CEMENT SPECIFICATIONS.

Prof. J. M. Porter, of Lafayette College, and Assoc. M. Am. Soc. C. E., reports that on a recent piece of work embodying over 4,000 cubic yards of concrete under his charge, the cement specifications called for, among other requirements, a tensile strength of 150 pounds for one cement to three sand mortar at the age of seven days. The first shipment of cement received on the work was sampled and tested and failed to fulfill the requirements for tensile strength and the contractor was so notified. At the request of the cement manufacturers their representative tested the cement with a result about 15 per cent. below the result first obtained. The manufacturers again requested that a representative from a certain testing laboratory be allowed to make a test. This request was also granted, and the result obtained was over fifty per cent. in excess of the first test and brought the cement beyond the requirements of the specifications. All these tests were made from the same sample of cement, using the same sand, mixed and molded in the same laboratory, and broken by the same machine.

To find what varying results different persons would obtain from the same sample of cement, Prof. Porter, had ten samples taken from as many barrels of a certain brand of Portland cement. These samples were thoroughly mixed together and portioned into ten smaller samples of average quality, which were sent to ten different persons, with a request that a seven-day tensile test, one to three sand, be

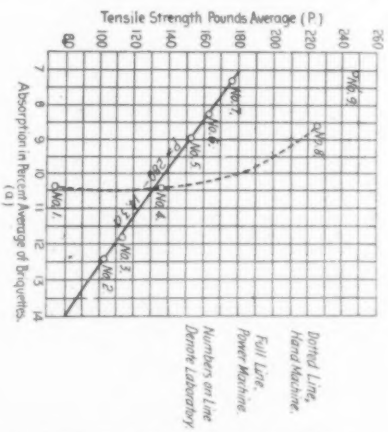


Fig. 1.—Diagram Showing Relation Between Absorption and Tensile Strength of Cement Briquettes Broken by Automatic and Hand Machines.

made according to their understanding of the method proposed by the Committee of the American Society

of Civil Engineers. The accompanying table gives the results obtained from nine different persons arranged according to their averages.

Commenting on these results, Prof. Porter says:

> What value has a tensile requirement in cement specifications under the present method of testing when one person obtains thirty pounds and another one hundred pounds as a result upon the same sample? The cement which one engineer would accept would be rejected by another under the same specifications. Where do the contractor and cement manufacturer stand in this matter? I know that cement can be made to stand almost any tensile requirement within reasonable limits that would ordinarily be made by varying the method of mixing and molding, but when the mixing and molding are supposed to be done in accordance with a given method and yet the results vary widely, either the method is at fault or the results have no value unless weighed by the varying personal equation of the manipulator.
>
> It may be said that when an engineer prepares his specifications for cement, he knows how much he can obtain from a good cement in the way of tensile strength. If this is the case he certainly must have had one or more brands in mind at the time of writing the specifications. Then why not specify the brands, stating chemical limits, time of setting, specific gravity, etc.? The objection to this method is that a given brand of cement will vary in tensile strength. Does any one suppose, however, that a well-established brand will drop much over seventy per cent. from the requirements that an engineer would ordinarily specify? According to the accompanying table the brand could drop that amount before it would be rejected by some other engineer under the same specifications.

Professor Porter had two men in his employ, both equally skilled in cement testing make a tensile test on five briquettes, one to three sand, on the same sample of cement. The tests were made in the same laboratory, the mixing and molding being done at the same time and the same bath was used, thus eliminating all atmospheric and water conditions. The results were to each other as 85 to 100; and if the lower one had been taken the cement would have fallen below requirements, while taking the higher result, the cement would have passed. The question was, which result to adopt? Again, two men employed by the same cement manufacturers and accustomed to making cement tests for their employers, made five briquettes each from the same sample of cement. The briquettes were broken by the same machine and operator with results standing as 50 to 100. All of the before-mentioned tests were made upon a sand mixture of three to one, and it might be said that if neat tests had been made closer results would have been obtained. This brings up the question as to the relative value of sand tests vs. neat tests, in which Professor Porter favors the former as they conform more nearly to practice. A given person skilled in cement testing can obtain results from the same sample of cement under normal conditions using the present method of testing within five per cent. of the mean value.

Prof. Porter says he knows a cement inspector in one of the larger cities who is frequently compelled to go out on work, take a large number of samples, return to his laboratory with possibly twenty-five pounds to thirty pounds of cement, and then go to work and make 100 briquettes. "Does any one suppose the last briquette made received the same work as the first one, or the first one the treatment that would have been given it if a fewer number of briquettes had been required? This is probably an extreme case, but, nevertheless, cements stand or fall upon this inspector's report."

The accompanying illustration (Fig. 1) shows the relation between the percentage of absorption of the broken briquettes and their tensile strength. The relation of the briquettes broken by power-driven machines is rather striking. The

term power-driven is applied to any testing machine which applies the load other than by hand.

Table Showing Results of Tensile Tests of One Part Cement, Three Parts Sand Mortar—Same Sample of Cement—Made by Different Persons in Accordance With Their Understanding of the Method Proposed by the Committee of the American Society of Civil Engineers.

Laboratory.	Tensile strength in lbs. of briquette. No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Aver.	Range in pounds.	Ratio of range to maximum.	Ratio of average to maximum.	Water, per cent.	Molds.	Kinds of surfaces of molds.	How placed in water.	Water bath.	Kind of Machine.
*No. 1. R. W. Hildreth & Co., New York	68	72	74	78	82	..	75	14	17.1	30.4	12.0	Single.	Both sides.	Flat.	Still.	Riehle, Driven by hand.
2. Washington University, St. Louis, Mo. Prof. J. B. Johnson	77	94	108	110	122	..	102	45	36.9	41.8	Not known.	Gang.	One side.	Flat.	Still.	Fairbanks, Johnson's Clip.
3. City of Easton, Pa. H. R. Fehr, City Eng.	106	112	123	.	.	..	114	17	13.8	46.5	10.4	Single.	Both sides.	Edge.	Still.	Fairbanks.
4. Columbia College, New York. Prof. W. H. Burr	125	126	130	137	140	144	133	19	43.2	54.0	10.0	Single.	One side.	Flat.	Still.	Riehle, Driven by hand.
	126	132	138	144	150	153	140	27	17.7	56.8	8.0	Single.	One side.	Flat.	Still.	
5. Chas. F. McKenna, New York	148	150	151	155	160	..	153	12	7.5	62.0	12.0	Single.	Both sides.	Flat.	Still.	Riehle-McKenna Power driven, Rubber clip.
6. Cornell University, Ithaca, N. Y. Prof. F. P. Spalding	155	160	164	166	172	..	163	17	9.9	66.0	Not given.	Single.	One side.	Edge.	Running	Lever with water bucket
7. Lafayette College, Easton, Pa. J. M. Porter	171	177	177	178	179	..	176	8	4.5	71.4	11.0	Gang.	Both sides.	Edge.	Running.	Olsen-Porter, Porter clip.
8. Clifford Richardson, Washington, D. C.	220	224	226	228	228	..	225	8	3.5	91.2	10.0	Single.	Both sides.	Flat.	Still.	Riehle, Driven by hand Rubber clip.
9. Booth, Garrett & Blair, Philadelphia, Pa.	240	246	249	250	252	..	247	12	4.8	100.0	12.0	Single.	Both sides.	Edge	Still.	Olsen, Power Driven, Rubber Clip.
Average.							153	12.9	12.9	62.0	10.8	77.8 % Single. 22.2 % Gang.	66⅔% Both sides. 33⅓% One side	55.5% Flat 44.5% Edge	22.2% Running 77.8% Still.	66⅔% Power 33⅓% Hand

* No. 2. water in bath changed once. No. 5. water not changed. No. 6. flow of water just sufficient to keep it fresh; No. 7. flow of water slight; No. 8, speed of applying load 25 lbs. to 40 lbs. per minute. All molds and sand Am. Soc. C. E. recommended sizes.

Upon examination of the broken briquettes, all of which had been returned, it was noticed that they had varied greatly in density. In a letter accompanying the report from one of the laboratories, it was stated:

The quartz grains are so nearly of one size that the volume of voids left to be filled by the cement is excessive. If the sand (or quartz) were of graduated sizes the cement would be used wholly for coating the grains and not for filling relatively larger voids. In this case the broken briquettes show clearly that the cement was quite insufficient to fill the voids, as the briquettes are quite open and porous.

The briquettes mentioned were extremely porous, while others were quite dense.

Prof. Porter comments on the tests as follows:

The percentage of absorption of the broken briquettes was assumed as a measure of their density, and was obtained by allowing the briquettes to remain in a dry room for two weeks or more, then placing them in an oven having a temperature of 100° C. They were taken out of the oven at the end of two hours and carefully weighed, then placed in water for 48 hours, removed and again carefully weighed. The absorption was computed in per cent. of the original weight and average.

The tensile strength of the briquettes broken by power-driven machines, with one exception, follows very closely $P = 280 - 14.3\ a$, where P is the tensile strength in pounds and a the percentage of absorption, obtained as above stated. From this relation, it would seem, if percentage of absorption is any measure of density, that the mortar for these briquettes received about the same mixing, and that the variance in tensile strength is due to the molding alone. While this may be true for the briquettes in question, I do not believe it true in general, as the mixing of mortar for briquettes is too important a factor to be decided one way or another by so few comparisons.

The percentage of water used by the different manipulators in making the briquettes varied 33⅓ per cent., due to the operators' varying understanding of the term "stiff and plastic" in connection with temperature. In one case a decrease of 20 per cent. in water gave an increase in tensile strength of 5.2 per cent.

Single molds were decidedly in favor, only two out of nine persons using gang molds. I believe it possible to obtain higher results from single than from gang molds, but if both were to be treated the same, the results would differ but slightly. A letter from one of the laboratories stated that results were about the same which ever molds were used. A person having a large number of briquettes to make will find without doubt that gang molds are preferable.

The placing of the briquette in water flatwise seems to be the favored position. The writer, however, prefers placing them in water on edge, as more surface is exposed to the direct action of the water. The objection to this method is the danger of the briquette changing form under the action of its own weight. The writer never has had any trouble from this cause, nor does he know of any one else who has had any.

Still water for the bath seems to be in almost general use. This is probably due to the difficulty and expense of having running water, which no doubt would be preferred if a choice were given. The practice of using the same still-water bath over and over again can not be too strongly

condemned. The writer knows of laboratories where this is common practice, and where fresh water is added in quantities sufficient only to replace that lost by evaporation. In running-water baths, the supply should be so arranged as not to come directly upon the immersed briquettes. This latter point is also often overlooked.

Power-driven testing machines are decidedly in the majority. The writer believes that hand-driven machines should be entirely abandoned, as it is about all an ordinary mortal can do to handle one crank without being compelled to take care of two. In power-driven machines the writer prefers those applying the load by the weight of water or shot to those applying the load by means of a screw driven by gearing and belts, as he believes the former to give a more uniform rate of increase. Figure 2 shows the construction of the machine designed by the writer.

The load is applied by water flowing into a tank suspended from the long arm of a very sensitive fifteen to one lever. The weight of the lever and tank is counterbalanced by an adjustable weight shown on the left. Water is admitted to the tank from a large reservoir on the roof under a practically constant head of ninety feet, so there is no sensible variation of pressure in the stream admitted through a carefully fitted gate valve in the supply pipe. The position of this valve at "on," "off" and all intermediate points is shown by an index attached to the stem of the valve and registering on a dial marked off with the number of pounds per minute applied to the specimen as determined and verified by previous experiment.

When the briquettes break the lever drops a few inches, then the plunger at the right end of the lever enters the pneumatic stop, and the lever and tank are gradually brought to rest. During the fall of the tank and before it comes to rest, a chain attached to the end of the valve stem in the tank is brought into tension and arrests the descent of the valve before its seat stops descending. The opening of this valve allows the contents of the tank to be quickly discharged into a hopper placed upon the floor, and is then carried off through a waste pipe to the sewer. As soon as the tank has discharged its contents, the weight on the left end of the lever brings the lever and tank into the position shown in the illustration, the valve taking its seat during this movement and the machine is ready for another break. The actual load can be applied at from 0 to 80 pounds per minute, thus giving an increase of stress of from 0 to 1,200 pounds per minute. The speed generally used is 100 pounds per minute, and with

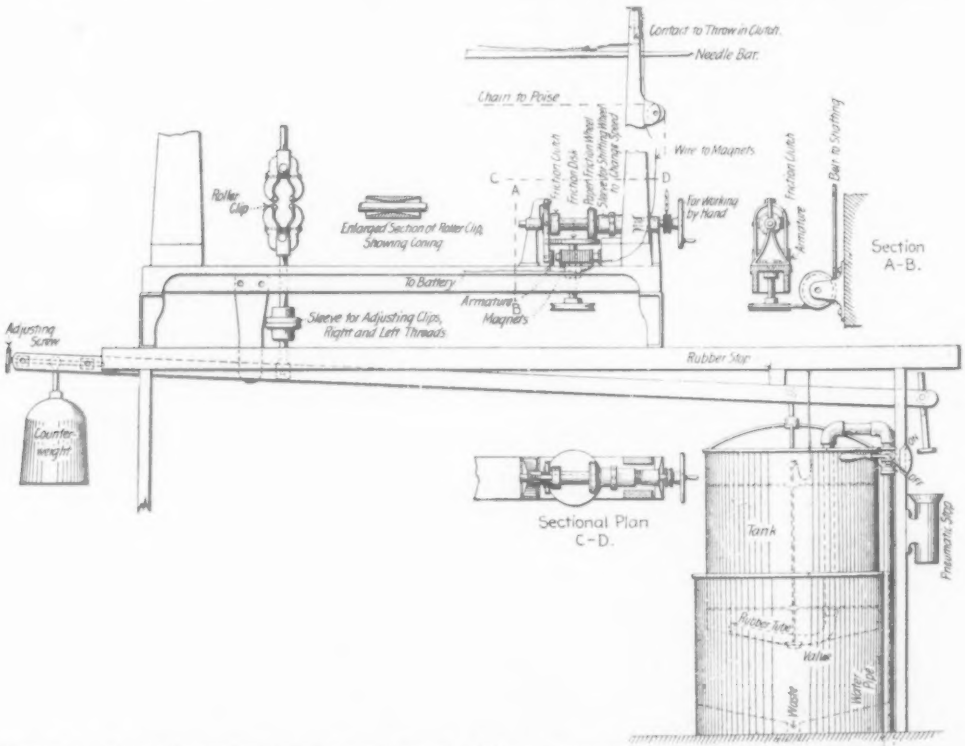


Figure 2—Automatic cement testing machine of 2,000 lbs. capacity; Lafayette College, Easton, Pa.

the valve set for this speed the needle beam will float every time within 1-5 second of the proper time.

The stress on the specimen is measured by a poise traveling on a graduated scale beam, which can be read by means of a vernier to one pound and can be moved automatically or by hand at the wish of the operator. The automatic movement is accomplished by the following described device:

The horizontal disk and its engaged friction wheel are driven continuously by the pulley placed at the lower end of the vertical shaft and belted to overhead shafting. This friction wheel is feathered to a sleeve that runs loose on its shaft and carries a coned clutch that is nominally disengaged from its cone, which is also feathered to the shaft, and can be moved slightly longitudinally on the shaft into contact with the clutch by the action of the vertical lever.

When the needle beam rises, it makes contact through a vertical pin in the top of the frame, which completes an electric circuit and sends a current through the electro-magnet and causes it to attract its armature at the lower end of the vertical lever, which moving to the right engages the friction clutch and causes the shaft to revolve. This shaft operates the sprocket wheel and chain which draw out the poise on the scale beam until the needle beam drops, breaking the electric circuit. Breaking the electric circuit releases the armature and allows the friction clutch to disengage and the poise comes to rest. The friction wheel may set at a greater or less distance from the center of the disk by turning the capstan head nut, and the chain is overhauled faster or slower, causing the poise to move accordingly. If desired, the poise may be operated by the hand wheel without interfering with the automatic device other than cutting out the circuit. The chain is attached to the poise in line with the three knife-edges of the scale beam, hence the tension in the chain has no tendency to lift up or pull down the poise. This point is often overlooked in designing this detail, not only in cement machines but in testing machines in general. The writer has a cement machine in which the error due to this cause is over fifteen pounds.

This machine, as described, has been in almost constant use for eighteen months, and has given entire satisfaction. The operator has simply to place the briquette in the clips, open the supply valve, wait until the briquette breaks and then note the reading on the scale beam. The objection to this machine is the space it occupies, requiring a floor area of 7 x 2 feet, and the necessity of a constant head of water.

From the figures given in the table it is evident that the personal equation is a decidedly important factor in cement testing, and before tensile requirements in specifications can have any meaning, a method must be adopted that will considerably reduce or entirely eliminate this factor. With this in view the following requirements are suggested: (1) Mixing and tempering by machinery, using enough mixture to make a given number of briquettes; (2) molding under a given pressure; (3) regulation in regard to the bath and manner of placing briquettes in the same; (4) abolishing the use of all testing machines applying the load by hand.

THE BEST COMPARATIVE TEST OF CEMENTS.

Erskine W. Fisher, in a letter, contends that neat tests of cement are of value to the manufacturers only, and that they afford no trustworthy measure of comparison of different brands of cement. He thinks that an admixture of cement and standard sand will give the best comparative test. The object to the consumer, he says, is the greatest strength and durability of the mortar or concrete, the strength of the cement being but an incident. "As a rule," he says, "a coarse cement will show a higher strength when mixed neat than a finely ground cement; but the reverse is the case, when the same cements are mixed with sand, the reason being that its power of adhesion to the aggregates with which it is mixed is increased in proportion to the fineness of the cement; and the more completely it covers the small particles of sand, the more solid and compact will be the stone or mortar obtained."

SAND CEMENT.

The manufacture of "sand cement" or "silicia" cement, which was begun in Copenhagen a few years ago, seems to be obtaining a foothold in this country, according to a pamphlet issued by a New York cement company. The following quotations will briefly explain the process of manufacture and the re-

sults obtained: Portland cement and sand are well mixed and then pulverized in a dry slate together. The result is the sand cement, which is then used as ordinary Portland cement, *i. e.*, mixed with usual sand and water to form a mortar. The object is a double one; firstly, the fine reduction, and, secondly, the thorough and intimate mixing of the two constituents. In a mortar made with sand cement by addition of usual coarse sand, the interstices between the particles of the latter are filled with sand cement, and the interstices between the fine sand particles of this are in their turn filled with cement, and this is done in a far more satisfactory manner than in usual mortar, because the sand and cement are ground together and therefore very intimately and evenly mixed.

The manufacturers claim for sand cement the cheapness and plasticity of lime mortars, with the hydraulic properties and greater strength of cement mortars. This is indeed a valuable combination, and it is to be hoped that good results may be realized in practice. It is also claimed that sand cement is especially applicable to sea work on account of the density of the mortars containing relatively large proportions of sand.

Among several tables of tests given we abstract one giving the results obtained by Mr. H. K. Bamber, an English engineer, who has given much attention to the subject of cement. The sand cement is here compared with an English Portland cement, which was the same as that used in the manufacture of the sand cement.

The English Portland before treatment and as used in the tests left 39 per cent. residue on a "No. 200 seive" — 40,000 meshes per square inch. The sand cement left about 3 per cent. residue on the same seive. The results obtained by Mr. Bamber are stated as follows:

Experiments.	Mixture by Weight.			Tensile strain lbs. per sq. inch.			
	Sand cement.		Sand not ground.	The mixture contains		7 days.	28 days.	3 months.
	Cement.	Sand.		Cement.	Sand.			
1	1	.....	3	1	3	113	178	255
2	1	.....	2	1	2	164	248	232
3	1	.....	3	1	3	111	197	260
4	1	.....	2	1	2	84	235	182
5	1	.....	3	1	3	95	215	124
6	1	2	3	1	5	.....	37	90
7	1	3	3	1	6	.....	35	66
8	1	4	3	1	8	.....	.....	.....
9	1	5	3	1	11	.....	.....	.....
10	1	6	3	1	15	.....	.....	.....
11	1	7	3	1	15	.....	.....	.....
12	1	8	3	1	15	.....	.....	.....
13	1	9	3	1	15	.....	.....	.....
14	1	10	3	1	15	.....	.....	.....
15	1	11	3	1	15	.....	.....	.....
16	1	12	3	1	15	.....	.....	.....

Gauged with per cent. of water.
11
9
7
6
4
35

It is known that the addition of a finely divided substance, such as clay, will sometimes increase the strength of a cement mortar. The value of fine grinding, and the fact that the coarser particles of Portland cement would form the best part of the product if well ground, have also been demonstrated. And finally, intimate mixture of the ingredients forming a cement mortar is known to be necessary to obtain the best results. Yet after considering all of these points such results as those quoted above can only be characterized as remarkable, and further tests of this new form of cement will be awaited with interest.

DEFECTIVE SURFACE OF CEMENT SIDEWALKS.

A correspondent of PAVING AND MUNICIPAL ENGINEERING expresses some difficulty in making a cement sidewalk retain a smooth surface. He does not give sufficient data to permit an accurate diagnosis of the trouble experienced, but there are several conditions which might lead to the disfiguration of a once finished walk.

While the top mixture should be thoroughly rammed or beaten and well trowelled, yet this treatment should not be continued so long as to bring to the surface a considerable quantity of neat cement, thus leaving the layer of mortar next below without sufficient cement to bind it together. If this is done the thin layer of neat cement may flake off when set, revealing a layer of almost clear sand below. A similar result obtains if one attempts to retrowel a surface once finished and partially set but afterward defaced. Sprinkling the walk before the cement has thoroughly set may cause blisters which mar the appearance of the work; on the other hand the walk should be protected from the direct rays of a hot sun or surface cracks may result.

GERMAN CEMENT INDUSTRY.

There are about 63 cement works in the whole of Germany. The Rhine is the principal center for this manufacture, but in the neighborhood of Hamburg there are three or four in operation for the production of the article. The annual production of Germany amounts to nearly 11,000,000 barrels, giving employment to some 1,800 hands, whose annual earnings amounts to some £698,780. The largest customers for this article in Europe are Russia and Norway, and of transatlantic countries, the United States, Brazil, Chile and Venezuela. The exportation to Great Britain and British Possessions is comparatively small. The following table gives approximately the quantity and value exported to European and other countries: Norway, 58,500 cwt., £6,700; Russia, 34,353 cwt., £2,900; United States, 1,386,872 cwt., £168,000; Brazil, 446,340 cwt., £40,000; Chile, 131,000 cwt., £13,000; Venezuela, 103,000 cwt., £9,800.

ANSWERS TO QUESTIONS.

[By J. W. Howard, B. L., C. E., for PAVING AND MUNICIPAL ENGINEERING.]

WHEN TO BEGIN AND STOP PAVING WORK.

When is the proper time to begin paving work in spring and stop it in the fall?
J. H. Birdsall.

The best time for paving is when the weather is fair and the ground dry. These conditions are seldom in the early spring or in the late fall. Frost and rain during these periods are the principal enemy of the contractor, and through poor work the city is injured. Nevertheless, if the contractor or city is compelled by circumstances to work under the adverse conditions of bad weather the greatest care must be observed, especially with pavements with concrete foundation.

If there is any danger of frost the concrete should be laid very rapidly and at once be covered with straw, hay or some other material to keep it from freezing. The surface, be it asphalt, brick or any other material, should not be laid during freezing weather.

Rain does not harm good concrete, but is liable to make the earth before the concrete is laid soft and muddy and unsuitable for a base under the concrete.

It is safe to say that varying with the differences of climate, paving should be begun when the time has arrived to be reasonably sure of having dry and fair weather—say May 1 in the spring and continue it until October 31. With great care and the exercise of good judgment, as a result of long experience, a contractor or city may venture to overstep these limits in some cases.

The rains in the south correspond to the same seasons as frost and snow in the north.

New paving should not be begun before April 15, when grading is permissible. New work, unless for very small amounts, should not be begun after October 1. Discretion should be given one experienced city official—the city engineer—to allow special exceptions by written authority in each case.

HOW CONCRETE SHOULD BE MIXED.

Should shovels or hoes be used for mixing concrete for pavement foundations?

Superintendent of Streets.

Paving contractors having large quantities of concrete to lay, prefer, as a rule, to use hoes. The work can be finished quicker and is done thoroughly with this tool. Four men with hoes are usually employed on one mixing board; two with shovels, one at each end to keep the ends in shape.

After the broken stone has been carefully spread over the cement mortar, the men with hoes roll the materials from one side, turning it over and over, then back again, thus making a good and efficient mixture.

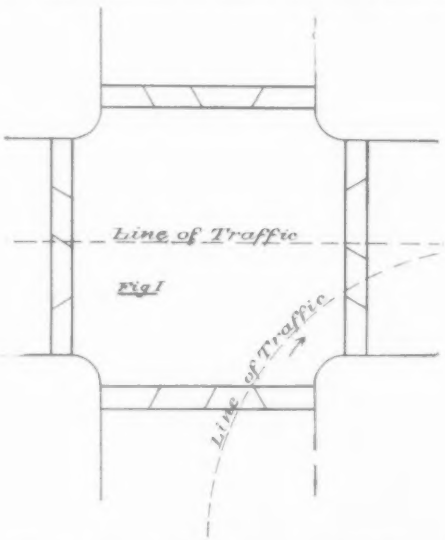
Shovels can also be employed to do this, but it takes a longer time to effect a good mixture and much mortar is lost if they work slowly.

Trained gangs of men with hoes and two shovelers, one at each end, do more rapid and better work laying concrete foundations for pavements than men with shovels only.

SQUARE OR BEVELED JOINTS FOR CROSSWALKS.

Should crosswalks be laid with square or beveled joints?

This is a matter of great importance upon streets where the traffic is heavy. It is now the practice where crosswalks are needed in several European and American cities to lay them with the joints beveled. The accompanying illustrations, Fig. 1 and Fig. 2, show the general principles involved in a vast number of cases where streets



either intersect or come together. The general rule is that the joints of the crosswalks should form an acute angle with the line of traffic likely to pass over the point where each joint lies. Where two streets intersect as in Fig. 1, the joints should point toward the center of the intersection. If there is a central

joint on each line of crosswalks or bridge-stones, that central joint can not, of course, point to the center of the intersection. It also should be beveled. The general rule first given, however, covers all cases.

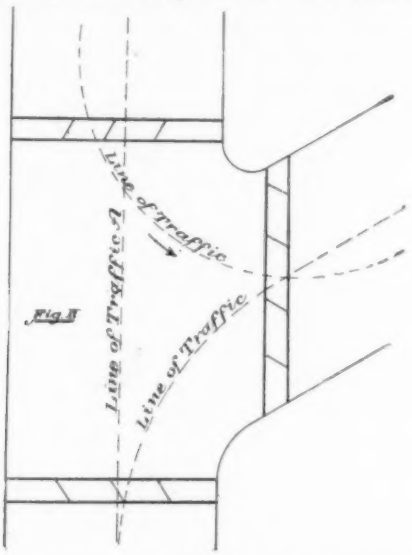


Fig. 8

It is true economy where a street has traffic to warrant a pavement of the character needing crosswalks to invariable have the walks laid with beveled joints. Care must be taken that the entire ends of the walks fit closely. If the vertical angles at the ends of the walks where they are jointed are not right angles, the excellent effect of the beveled joint is lost. In many eastern cities blue-stone is used for crosswalks. This stone being soft, compared with granite, is a good reason why all blue-stone crosswalks should have beveled joints.

It is hardly necessary to call attention to the fact that, when the joints are square or lie in the line of traffic, the wheels rapidly chafe the joints, making disagreeable holes which make walking uncomfortable as well as impede vehicles.

It is naturally best to adopt a standard angle for the bevel, say fourteen or fifteen degrees, which would make a joint extend back six inches from the end of each stone of a width of two feet.

Crosswalks are not necessary where a street is paved with asphalt, brick or perfectly-cut granite block. The presence of crosswalks on anything but a macadam or telford street, is evidence that the pavement is imperfect and not smooth enough for walking across, and hence can not be regarded as smooth enough for traffic.

Crosswalks are claimed as necessary on some streets because of neglect of the city to keep the streets clean. This reminds us of the time when we used to pay a penny or two several times a day to the little crossing-sweepers who were formerly so celebrated in touching stories and otherwise in New York, Philadelphia, Baltimore and elsewhere. With better cleaned streets these children obtained better employment in other walks of life. Even the crosswalks have disappeared with the advent of evenly paved and well cleaned streets.

WHEN STREET PAVEMENTS SHOULD HAVE A CROWN.

A street thirty feet wide, one side about nine inches higher than the other is to be paved. Should this street have a crown or not?

Assistant Engineer, Louisville.

Every effort should be made to have the tops of curbs, if possible, in the same plane. If one curb must be higher than the other, you have one of the difficult problems in connection with street construction and paving. No general rule can be given. Good judgment is required, or what is so aptly termed "horse sense," in each case. For a roadway thirty feet wide and a difference in height of only nine inches of one curb above the other, a crown should generally be given

to the pavement. On all roadways of greater width than this, and a proportionate difference in height of curbs, crowns are almost imperative. The highest point, however, of the pavements should not be in the center of the street, but placed at about one-third of the distance across the street, measuring from the high side. The lower gutter will thus be relieved of an excess of water during heavy rains.

An excellent way to reduce the difference in heights of the two sides of the street pavement is to have the pavement of the upper side laid so as to be eight or ten (sometimes twelve) inches below the top of the curb; at the same time making the pavement on the low side of the street only four or six inches below the top of the curb. This will result in a pavement pleasanter for travel; whereas the difference in depths of the gutters is of little moment if the curb-stones are well cut and the pavement well laid and the beauty of the street is not so much impaired as would be the case if the pavement was laid one-sided or unduly tipped toward the lower gutter.

For a street only twenty feet wide the crown should be omitted and the pavement laid in a straight line from gutter to gutter, although it is often wise to have more of the curb-stone on the upper side exposed than on the lower, to prevent the pavement giving too much pitch toward the lower side.

In addition to the traffic and beauty of a street, the drainage, the position of the sewer basins and the relation of the whole to intersecting streets must be borne in mind.

If streets thirty feet wide and more are laid without crown, there is danger that in time the center which receives the most wear will become slightly depressed and retain a little water to the eventual injury of the comfort, cleanliness and beauty of the roadway.

ARTIFICIAL AND NATURAL STONE CURBS.

Are there any kinds of artificial curb which experience has shown to successfully take the place of suitable natural stone? *Engineer.*

Artificial stone curbs, made with Portland cement as a base, are the only safe substitute for natural stone. No other manufactured material seems to have proven serviceable for permanent curbs. The best artificial stone only supercedes the natural stone, however, in regions where a proper quality of tough, hard and smooth natural stone is expensive, or where on private drives or special streets in residence or park districts a combined curb and gutter of cement-stone is desired.

Hudson river blue-stone curbing will cost in the section of country about New York say sixty cents per lineal foot, more or less as to its "finish" or "cut."

Artificial stone curbing has been made and set in place for fifty cents per linear foot. A valuable feature of artificial stone curbing is that the curb and gutter can be combined in a monolith as in a few streets in Washington and Chicago.

Cast iron curbs, in reality a shield of metal protecting a concrete backing, are costly and their durability in most forms of construction is lessened by the rusting away of the stay-bolts used to hold the iron in place. The cost of securely bedding the casting in concrete, and the difference in rates of expansion, are difficulties that arise if stay-bolts are omitted. Pieces of cast iron used with Portland cement to make a species of concrete is a practicable modification, but is of doubtful advantage.

All efforts to make shale or fire-clay curbs for cities fail, because of the difficulty, even, with the best form of down-draft kiln, of baking or vitrifying uniformly so large a piece as a curb block is required to be. By the time the interior of the block is properly baked, the vitrification of the exterior has been carried too far. Also the permanent internal strains in such a large unequally baked mass, make it liable to crack under the blows of ordinary street traffic.

If for economy in a few places, or for beauty in others, an artificial stone curb is desired, a well made and well laid Portland cement combined with crushed granite, slag or very sharp clean sand will produce good results.

USE OF SCORIA BLOCK ALONG STREET CAR RAILS.

We wish to learn about the Scoria block as used in paving along street car rails in connection with sheet asphalt pavements. We appreciate your valuable magazine.

Narragansett Improvement Co.

It makes a better street and in the end is more economical to lay asphalt pavements directly against street rails, if the rails are of the grooved type. Such rails are used in all European and a few American cities. If the rails are a side-bearing or L class, it is best to lay the asphalt directly against them, provided the rails are solid girders or otherwise unyielding. But with center bearing or T rails, "toothed" stone blocking must be used, as well as along other rails which are loose or fastened to wood stringers.

Cut granite block for toothing along rails have a more uniform texture than Scoria or slag blocks. The principal advantage of Scoria blocks is their regular shape, fitting closely against the rail and each other. Scoria blocks made in England are generally from selected slag from iron works. The slag while still hot is run into molds. This has been tried in the United States, but as far as we know there are none made at present in this country. The lack of uniformity of material, as spoken of above, is the reason of the failure heretofore to establish a market for these blocks. A few have been imported from England. They were unusually hard, showing that well selected slag blocks would make a pavement which would be durable, if of no other advantage.

CURRENT INFORMATION.

PROPOSED PROHIBITION OF THE USE OF IMPORTED PAVING MATERIALS.

A bill has been introduced in the senate at Albany, N. Y., by Assemblyman Leonard, of New York city, which provides that no asphalt, wood, or other pavement which is composed wholly or partly of foreign material shall be used in the streets of any city or village in that state. It seems to belong to the class of proposed legislative measures which constitute the business of New York politicians. It is, of course, causing much comment.

The bill came up before the committee on cities, March 17. Mr. Leonard, in advocating the passage of the measure, said that the American asphalt was the best material and it averaged 30 per cent. higher than the test. Ex-Assemblyman Niles spoke against the bill, maintaining that it would have a tendency to create an asphalt monopoly. The bill is still in the hands of the committee.

Gen. Collis, the commissioner of public works of New York city, has addressed letters to the mayor and corporation counsel, asking them to adopt energetic measures to defeat the bill. He says, "I have no idea that the legislature will pass the bill or that the governor would sign it if passed. If, however, it should become a law, I should refuse to do any more asphalt paving, as the matter comes within my option."

Mr. Nelson P. Lewis, engineer of street construction in Brooklyn, says it is hard to believe that any one can take such a measure seriously, and that "it is preposterous to think that we should be shut out from buying the best that can be produced in the markets of the world."

Mr. Edward P. North, of the department of public works, New York city, says: "Asphalt would be practically the only material affected by the passage of the bill. I take it it uses the word foreign in a literal sense, and not from the interstate standpoint. At present we have in the market Trinidad and Venezuelan asphalt, and European rock asphalt. These constitute the foreign brands and are controlled by about seven competing companies. A domestic supply has been fully developed in California by the California Asphalt Company. Its plant is located in the southern part of the state, near the coast. The California product is excellent and sells at the same figure as the foreign brands. We have used considerable of it in this department."

The New York *Mail and Express* editorially says that "the bill is absurd on its face," and opposes it. The bill is fathered, the *Mail and Express* says, by Senator Maurice Featherson, Tammany's representative from the eighteenth district, and formerly water purveyor in the public works department. The *Mail and Express* further says: "Even if otherwise proper and feasible, such legislation is an unwarrantable invasion of the federal province. If American asphalt is to be protected against foreign competition it should be accomplished by tariff legislation, not by state laws."

New York paving companies using foreign materials say that they

will give the bill no attention, because, even if it should be passed, it is unconstitutional.

BETTER AND CLEANER STREETS IN ST. LOUIS.

The movement to radically reform the paving of resident streets in St. Louis, Mo., was begun March 10, when ordinances were introduced in the house of delegates to improve seven west end streets with brick. The city officials recognize that to have clean streets it is necessary for them to have hard, smooth surfaces. Street Commissioner Milner is a strong advocate of brick or asphaltum streets, and will endeavor to have all streets paved with these materials in the future. Another method of keeping the streets clean will be put in force this year, which is to compel the contractors to use sprinklers with smaller holes so that the shower of water will be lighter and thus lay the dust while it does not make the street muddy. Many complaints were made last year of the flooding of the streets. A systematic agitation of better and cleaner streets has begun, and the interest is increasing daily to such an extent that it will, no doubt, materially aid the street department in securing the amount of money asked for by the street commissioner.

At a joint meeting of special committees from the various organizations which have indorsed the movement for clean and better streets in St. Louis, in the office of the Business Men's League, the Merchants' Exchange, the Business Men's League, the League of American Wheelmen, the Real Estate Exchange, the St. Louis Furniture Board of Trade, the Manufacturers' Association and the Commercial Club were represented by prominent members and citizens. Mr. Frank Gaiennie, of the Business Men's League, set forth the objects of the meeting. He said that in order to get better and cleaner streets for St. Louis this year it was necessary to obtain additional appropriations; the appropriation for cleaning the streets last year was $135,000; for grading, $60,000, and $50,000 for excess in making new streets, but the two last sums were not used. Mr. Gaiennie indorsed the block patrol system which is now in vogue in the down-town district. This system of street sweeping was described in the February number of PAVING AND MUNICIPAL ENGINEERING. Mr. Gaiennie declared that an additional appropriation of $100,000 was needed, and that the total appropriation this year ought to be not less than $350,000.

Mr. Robert Moore, who represented the joint committee from the Commercial Club, Business Men's League, Mercantile Club and Merchants' Exchange, said that an attorney would be appointed to ascertain if the present condition of the streets is due to the want of adequate legislation or the lack of proper attention on the part of public officials.

LIABILITY OF A CITY FOR DELAYING A CONTRACTOR.

A verdict has been rendered against the city of Detroit, Mich., in favor of George Hanley, a paving contractor, in Judge Lillibridge's court. In 1893 Mr. Hanley obtained a contract for repaving a street, and had large quantities of granite block and other materials in the street ready for use, and several carloads in transit. Mr. Hanley received, October 3, a communication from Commissioner McVicar, of the board of public works, requesting him to stop repaving at the intersection of De-

quindre street. The order was given because Michigan and a number of other streets were torn up, and the public generally was complaining because traffic was impeded, and because the paving season was about over.

Mr. Hanley claimed that he was put to an expense of $3,500 by being obliged to store the material which he had on hand and on the way. In behalf of the city it was claimed on the trial of the case, that the board of public works can not render the city liable for damages by stopping the work of repaving on any of the streets, and that Mr. McVicar's action was not the action of the board. The damages awarded Mr. Hanley amount to $5,289.01. The case will probably be carried to the supreme court.

FIFTEEN YEARS OF LITIGATION OVER A DITCH.

A supreme court decision was rendered March 10 in the case of Schrack et al. *v.* Covault, affirming the decision of the Blackford circuit court, at Hartford City, Ind. This is a ditch case which has extended over fifteen years, and it is said that the supreme court decision will not put an end to the matter, as the contestants will make one more stand by attacking the drainage commissioner and the contractor on their bonds. The Lick creek ditch was begun in 1851; it is thirteen miles long and cost $23,000. It was made wider than the plans and specifications called for in order to permit the use of a dredge in the construction, so that when completed it resembled a canal, and this caused the litigation which has resulted in bankrupting a number of farmers, and this last decision will financially ruin a number of others. The suits which resulted have gone to the supreme court several times, each time being decided against the contestants.

A GENERAL ASSESSMENT PLAN FOR STREET IMPROVEMENT.

A general assessment scheme has been proposed by Alderman Cox, at Albany, N. Y., whose plan is to issue bonds for paving, laying drains, repairing streets, and for all general street improvement, including the opening and laying out of streets; that the pavement to be laid each year shall be limited to a certain number of miles; that all unpaid assessments shall be vacated and paid by the city. As now presented it is scarcely probable that the plan will ever develop, as it will meet with strong opposition.

Since 1885 more than 21 miles of streets have been paved and many thousands of dollars have been assessed for these improvements upon the abutting property, and to compel these taxpayers to contribute to the expense of paving the streets in other parts of the city is regarded as unjust.

In commenting on the plan City Engineer Andrews said:

"It would be an injustice to those people who have been assessed for the miles of pavement already laid. Less than one half of the pavements in the city are of cobblestone. The old system has been in effect too long to start this new scheme now. Alderman Stevens discussed a similar plan last year, but his intention, I understand, was to refund the money already paid for improvement, and make then a general assessment. It would be a difficult matter to do that, yet it would be the only just way."

PAVING IN BELFAST.

In response to inquiries made by James R. Conway, city clerk at Peoria, Ill., on paving, Jas. B. Taney, United States consul at Belfast, Ireland, says: "The asphaltum used in Belfast is the lime rock, and is obtained from the North of Germany and Sicily. Asphaltum, however, is not used on the streets, but has been used to a limited extent on the sidewalks. Perhaps a mile would cover all the area upon which asphaltum has been placed. The foundation is of concrete from three to four inches thick, and the asphaltum thereon would be about three-quarters of an inch thick. The duration of wear is from ten to fifteen years, depending upon the amount of traffic thereon. They give satisfaction for at least five years. Belfast has not laid any asphaltum pavement for twenty years. The prices quoted per square yard are $1.39 for three-quarters of an inch upon a bed of two-inch concrete, $1.64 for one inch upon two inches of concrete, one and one-half inches upon four inches of concrete, and two inches upon six inches of concrete. Most of the roadways or streets of Belfast are macadamized."

POPULARITY OF BRICK IN CHICAGO.

The testimony of the business men on La Salle street, between Madison and Washington streets, Chicago, is reported to be quite favorable to brick for street paving in that city. For a short street the pavement has had a much more severe test than any other street running parallel with it, for teamsters will go a block out of their usual route, to take advantage of its smoothness, which makes it easier for drawing heavy loads than the granite block pavements. There are many comparisons made by the business men, favorable to brick, between this brick paving and granite, Belgian block and wood.

A PLAN FOR EASIER PAYMENT FOR STREET PAVING.

A bill is before the Iowa legislalature which proposes a law permitting cities to issue bonds for paving street and alley intersections. Section 1 of the bill provides that cities under special charter now authorized to levy a tax for paving intersections are empowered to issue bonds, running the same length of time, bearing the same rate of interest, and in general purport the same as improvement bonds, issued to pay for paving which is assessable upon abutting property. Such bonds shall be known as "street intersection bonds" and payable out of the paving tax assessable under the provisions of said chapter 38 of the nineteenth general assembly, and be considered only as an anticipating appropriation of such tax, and shall not be issued in an amount not justified by the fund that will be realized from the tax to be assessed. If passed, this bill would allow the paving of streets when the property owners want it and the city is hampered for want of funds.

THE PARKING OF STREETS.

The question as to whether it is better to have parking between sidewalks and the curb of the street or between the sidewalks and the property line, with the sidewalks immediately next to the street curb, has long been under discussion in Indianapolis. As an experiment cement sidewalks were last year built next to the street curb on North New Jersey street, leaving about twelve feet of parking be-

tween the sidewalk and property line. There is a division of opinion among citizens and officials as to the beauty and advantage of this plan. City Engineer Jeup regards it with favor where the parking is made uniform under the supervision of the city, and City Park Engineer Power criticizes it as an objectionable departure from the original plan of the streets. Washington and Indianapolis were originally laid out by the same engineers, and the streets of the two cities are much alike in general appearance. Referring to the innovation on North New Jersey street, Park Engineer Power says: "I hope never to see any more streets of this city paved as North New Jersey street. We have a beautiful city and the more we pattern after Washington the more beautiful it will become. If this is desired then let the pavements run from the property line to the curb, or, to be more economical, let the walks be next to the property line and a strip of parking between the walk and the curb for grass and trees.

"Another matter which is becoming very important is the proper care and planting of the street trees. Transplanted trees do not thrive well when planted close together and each class of trees must be planted at proper intervals to have healthy, handsome trees. The different class of trees require different distances between them, and in Washington this varies from thirty feet in the case of the Norway maples, lindens, sweet greens, etc., to fifty feet in the elms. All the trees in the city of Washington are under control of a commissioner that cares for the thousands on its streets. The trees have not been indiscriminately planted and each street and avenue is planted with one kind of tree for at least a sufficient distance to insure a fine effect, and in many of them the same kind of tree is planted throughout their entire length. In this we could well afford to take some lessons, for every individual has had his preference of trees and the result can scarcely be called satisfactory or fine in appearance."

LITIGATION OVER ASPHALT PATENTS.

George B. Morris, as referee in the long pending suit of Averill v. Barber and others, filed a report early in March, in New York, which the press of the country quite generally has erroneously represented to be not only a final determination of the case against the defendants by the award of $406,000, but also that it would involve in heavy liabilities all cities where asphalt pavements have been built. The suit on which the report is made is one of several of similar nature instituted in different forms in the last thirteen years, all of which have either been defeated or are now pending on appeal. These suits have involved certain alleged infringements of patents claimed by Gen. Averill, who was one of the incorporators of the American Asphalt Paving Company, which went out of existence soon after its formation, and subsequently asphalt paving in America was brought to a success by the company formed by Mr. Barber and others.

The final result of the litigation may not be known for a long time. Thirteen years have elapsed since the beginning of the suit, and the referee's report on the testimony will now go to the court for revision and decision.

Existing asphalt pavements, by whatever company laid, have but a very slight, if any, connection with

this suit. It does not involve the importation or mining of asphaltum, nor its use by any person or persons, except possibly some laid in the past by Mr. A. L. Barber and his associates.

At the present time no patents are in force or claimed in connection with asphalt pavements, either in regard to the method of laying or the mixtures used. All paving companies are free to lay what mixtures they like, provided they use the natural asphaltum required by specifications, such as Trinidad, Bermudez or California, or any of the asphaltic limestones or rock asphalts from Germany, France and other parts of Europe. Certain coal-tar mixtures under the names of vulcanite, etc., which are imitations or adulterations of asphalt pavements, are patented and these are the only kind affording a basis for patent litigations.

AN ILLEGAL CONTRACT FOR VIADUCT CONSTRUCTION.

A decision has been handed down by Judge Butler against the city of Denver and the board of public works, in the Fourteenth street viaduct case. The suit was brought by George Metz and seventeen other taxpayers, to test the legality of the action of the city in forming the Fourteenth street viaduct improvement district under the act of 1891, under which the cities of Denver and Highlands endeavored to complete the viaduct. The court finds that as the charter of the city of Denver, passed in 1893, authorizes the construction of viaducts, making general provision for that kind of improvements, covering, in fact, the whole subject of viaducts, that the charter, being the later act, repealed the former act by implication, and that the act of 1891 is, therefore, of no effect so far as the city of Denver is concerned.

The court further finds that the act of 1891 is unconstitutional in granting corporate powers to the city of Denver. The act is a general law and can not confer powers on a city existing under a special charter. The city of Denver must derive all its powers from the charter and can not proceed under this act. The injunction is made perpetual.

The injunction restraining the city of Highlands from issuing bonds for the completion of the work has been dissolved. Under the decision the city can not enter into an agreement with any other city to complete the work, so that if it is completed the city of Highlands will have to build it, or it can be accomplished by the annexation of Highlands to the city of Denver.

PAYMENT OF STREET PAVING BONDS.

On account of the varying decisions which have been rendered by Judge Brown, of the circuit court, and Judge Bartholomew, of the superior court, property owners in Indianapolis, who became delinquent in the payment of their street improvement assessments under the Barrett law this spring, are threatened with litigation. In a case of several property owners against Treasurer William H. Schmidt, Judge Brown held that under the provisions in the Barrett law the treasurer had no right to receive payments of street improvement assessments after they had become delinquent. The question then became a point of issue between the bondholders and the property owners, and, as provided in the law, the bondholders had the right to bring suit for the foreclosure of the improvement lien and the collection

of the full amount of the bond. This decision was given under the theory that inasmuch as the legislature had the right to make it a law, it also had the right to provide means for its enforcement, and it had provided this method. In the case of the Indiana Bond Company against property owners in Irvington, which was a suit for foreclosure on property on a bond executed for street improvements under the Barrett law, Judge Bartholomew held that the bond company had the right to a judgment for the amount of the delinquent assessment and interest from the time they became delinquent, but could not foreclose on the full amount of the bond.

DEPRIVING A MAYOR OF THE APPOINTING POWER.

An ordinance, passed in the city council, February 26, at Baltimore, Md., deprives Mayor Hooper of his right to appoint municipal officers. This action results from a controversy of nearly a month's protraction, between the mayor and the council over the question of incumbents for the offices which came under the control of the Republican party last November. Immediately after adopting the ordinance divesting Mayor Hooper, other ordinances were adopted declaring vacant about fourteen places which had been previously filled by the mayor and confirmed by the council.

COST OF ENGINEERING IN THIRTEEN CITIES.

City Engineer Thompson, of Peoria, for the purpose of comparison with his own office, has recently collected information as to the cost of engineering in several cities in 1894. Letters received by him from city engineers show the following:

City.	Population.	Cost of Public Works, 1894.	Cost of Engineering, not includ. Inspec'rs.	
			Amount.	Per cent.
Burlington, Iowa	25,600	$ 116,587.68	$2,300.00	1.81
Charleston, S. C	60,000	70,000.00	3,880.00	5.54
Columbus, O	130,000	750,000.00	20,000.00	2.66
Duluth, Minn	59,396	56,226.89	5,354.30	9.50
Kansas City, Mo	150,000	597,681.69	25,850.00	4.32
Memphis, Tenn	75,000	77,451.47	9,196.06	11.87
Minneapolis, Minn	192,358	1,036,000.00	39,000.00	3.56
Reading, Pa	70,000	200,000.00	6,360.00	3.18
Saginaw, Mich	60,000	200,035.00	8,500.00	4.25
Salt Lake City, Utah	50,000	140,000.00	16,500.00	11.78
Syracuse, N. Y	110,000	524,659.29	15,000.00	2.86
Toledo, O	120,000	358,646.10	17,475.00	4.87
Troy, N. Y	68,000	375,000.00	7,500.00	2.00

The average cost of engineering in these thirteen cities was 5.24 per cent. of the work superintended. The cost of the engineering in Peoria under Mr. Thompson's supervision was 1.81 per cent. of the work superintended.

LICENSING OF CIVIL ENGINEERS.

A bill has been introduced in the Mississippi house of representatives by Mr. Judson Russell, of Meridian, Miss., to create a board of civil engineers and to require the licensing of persons who desire to practice engineering and surveying.

LOCATING Y'S IN SEWER CONSTRUCTIONS.

Mr. A. D. Thompson, city engineer of Peoria, suggests in his annual report that in constructing sewers there is no item more important, aside from procuring good workmanship, than that of locating the position of Y's and slants accurately and recording the location

permanently. They are the openings left in the sewer for the connection of the house pipes, and an error in the location involves a heavy extra cost to the property owner when the house connection is made, as it is necessary in such cases to cut an opening into the sewer, and the connection even then is unsanitary and unsatisfactory. After the sewer trench is filled there is no opportunity for correcting errors in measurements, or in the notes. An entirely new plan for making and recording these measurements has been used by Mr. Thompson. During construction the inspector on the work locates each Y or slant as soon as laid by a measurement from the center of the manhole below. This measurement is made twice, and the distance then noted in a field book in which the sewer line is sketched. These field books are turned into the office as rapidly as they are filled, and the line is platted in a properly indexed plat book, in which will also be platted the house connection when made.

REGULATION OF STREET SPRINKLING.

An act to regulate the sprinkling of streets, avenues, alleys, roads, highways and public places has been introduced in the New Jersey legislature by Hon. Horace L. Allen, of Hoboken. It forbids sprinkling within three feet of the curb, and requires a forfeit of ten dollars for each violation of the rule.

A GREAT OPPORTUNITY FOR BIDDERS.

The New York *Tribune* says that the following notice was recently posted at Milburn, N. J.:

The township commissioners will receive bids for the furnishing, spreading and delivery of crushed stone throughout the township, all bids to be in Friday morning, ——, 1896.

The commissioners will reject any and all bids. CHARLES A. PALMER,
Town Clerk.

UNPROFESSIONAL.

"What has become of Plodder, who used to be one of the assistant superintendents of the street department?"

"He was fired for incompetence, or something of that kind. They found out that whenever he tore up a street he replaced the paving stones exactly as they were before. A man with a record like that couldn't hold his job in this town." — *Chicago Tribune.*

PERSONALS.

Capt. A. Wilkin has been elected mayor at Keosauqua, Iowa.

Mr. S. Curtman has been elected city engineer at Steubenville, O.

Mr. S. S. Gaines has been appointed superintendent of streets at Vergennes, Vt.

Mr. James H. Case has been elected president of the water board at Newburgh, N. Y.

Mr. W. H. Lord has been appointed superintendent of water works at Ballard, Wash.

Mr. W. D. Hunter, Melrose, Mass., has been appointed city engineer at Waltham, Mass.

Mr. Henry M. Phipps has been appointed superintendent of streets at Hyde Park, Mass.

Mr. Henry H. Rogers has been appointed superintendent of streets at Fairhaven, Mass.

Mr. Andrew W. Bryne has been re-appointed street commissioner at Medford, Mass.

President Putnam and Superintendent Thomas, of the water board, Lowell, Mass., have been re-elected.

Mr. Cephas Browne has been appointed secretary of the board of water commissioners, at Atlanta, Ga.

Mr. Nicholas Augustus Northup, of the city works department, Brooklyn, N. Y., died of heart disease February 22.

Mr. Robert R. Dewar has been elected president of council, and John Wallace street commissioner at Millvale, Pa.

Dr. Henry Leffman addressed the Engineers' Club, Philadelphia, Pa., March 7, on the relation of drinking to disease.

Mr. John Johnston has been elected president of council at Bellevue, Pa. Mr. James Simeral has been elected clerk of council.

Mr. Charles A. Allen, C. E., of Worcester, Mass., has resigned his position as a member of the Metropolitan Water Board, of Boston.

Mr. John T. Cavanaugh, acting superintendent of the water department, Quincy, Mass., has been elected superintendent for three years.

Mr. Alexander Delaney, a well-known mechanical engineer at Richmond, Va., has been elected superintendent of the pump houses.

Dr. E. Frankland, F. R. S., delivered an address on the "Present, Past and Future Water Supply of London," March 18, at Philadelphia, Pa.

Mr. F. L. Stone, who for four years has served as assistant city engineer, at Rock Island, Ill., has opened an office in that city as civil engineer and surveyor.

Mr. William H. Bryan, consulting engineer, St. Louis, Mo., has associated himself with Mr. H. H. Humphrey in consulting, electrical and mechanical engineering.

Col. George E. Waring, Jr., of the street department, New York City, recently addressed the special sewerage committee of the general council, at New Orleans, La.

Mr. D. D. Sprague and Mr. J. H. Hayes have formed a partnership to carry on an engineering and contracting business, with offices in the Gill block, Springfield, Mass.

Mr. Sibbett Macrum has been elected president of council, N. D. Houghtelin clerk, Godfrey Brenner treasurer, and George Hulton street commissioner, at Oakmont, Pa.

Mr. Ernest McCullough, C. E., editor of the *Engineer and Contractor*, San Francisco, Cal., has, owing to increased practice, decided to permanently suspend publication of the journal.

Mr. Frank C. Kelsey has been appointed city engineer at Salt Lake City, Utah, to succeed Captain Willard Young. Mr. Kelsey has served as assistant city engineer since 1890.

Mr. Walter M. Hay, C. E., has resigned his position as superintendent of public work and city engineer, at Muscatine, Ia., to take effect at once, and has accepted the position of engineer in charge of the large sewer contract in that city for Messrs. Wilson, Jackson & Co., contractors.

Mr. Charles Pickett, who has served for twenty-six years as superintendent of the water works at Beverly, Mass., has resigned his position. Mr. Charles W. Pickett, his son, will succeed him.

Mr. James Rutheford has been elected superintendent of the board of public works at Braddock, Pa. Mr. A. S. Brubacker has been elected borough clerk and Mr. John Howard ordinance officer.

Mr. William H. Hawley, Newark, N. J., has been appointed superintendent of water works at Atlantic City, N. J., to succeed Mr. George T. Prince, who has been appointed chief engineer of the water plant at Omaha, Neb.

Assistant City Engineer Ellis, of Toronto, Canada, visited Cincinnati, O., March 17, to inspect the brick paving of that city, to obtain copies of the specifications, and to ascertain the qualities of the different brands of brick.

Major J. W. Howard, C. E., New York city, delivered an address, March 14, on "Permanent City Pavements," before The Town Improvement Society of East Orange, N. J., which has so successfullly influenced improvements there.

Mr. Wells, superintendent of streets, Boston, Mass., has made appointments as follows: N. S. Brock, engineer of construction; J. L. Kelly, deputy superintendent of paving; L. J. Finneran, deputy superintendent of street watering.

Mr. Henry P. Wires, Rockport, Me., has been appointed superintendent of construction of the New England Public Works Co. Mr. Wires will superintend the construction of a gravity system of water works at York Beach, Me., this year.

Capt. D. Torrey, of St. Louis, who has had many years of experience in the asphalt business, announces that he has invented and perfected instruments for the determination, in a scientific manner, of such physical properties of asphaltic paving cements as indicate their fitness for paving construction. "It is therefore practicable by such determinations," he writes, "to make a comparison of the relative merits of asphalts already in general use; to lessen the liability of incurring great cost in maintaining asphalt paving which attends the trial of new asphalts or of new formulas with asphalts now used." Capt. Torrey will make examinations of asphalts and preparations of them for cities and others wanting the information.

RECENT INVENTIONS.

[Reported specially for PAVING AND MUNICIPAL ENGINEERING, by A. I. Gardner, Attorney at Law and Solicitor of Patents, Loan and Trust Building, Washington, D. C. Copies of any patent can be secured for ten cents each.]

553,753. *Street Sweeper.* A. Hankey, Boston, Mass.

553,881. *Road Scraper.* H. M. Weaver, Mansfield, Ohio.

554,421. *Steam Street Roller.* C. O. Heggem, Massillon, Ohio.

555,226. *Street Indicator.* William Straley, Cleveland, Ohio.

556,039. *Apparatus for Raising Sewage.* S. H. Adams, London, England.

555,014. *Means for Conveying Water Over Hills or Mountains.* R. Mannesmann, New York, N. Y. Assignor to the Mannesmann Tube Company, Jersey City, N. J.

554,732. *Street Sweeper.* T. J. Robertson, Golden, Mo. Consists of a wheel-supported dirt-receptacle, provided with devices for sweeping, receiving and elevating the dirt, which can then be carted away and dumped.

554,168. *Street Cleaning Machine.* C. Beckwith, Herkimer, N. Y. The method of cleaning streets which consists in simultaneously sprinkling the street, and dynamically transferring the trash to a carrier by a forceful mixture of compressed air and aqueous spray.

553,736. *Electric Railway System.* J. F. Page, Chewacla, Ala. Sheaves are mounted to rotate at the ends of a motor car, an endless cable is carried on said sheaves, means for driving said cable is provided, and means for elastically depressing the central portion of the cable below the sheaves.

553,749. *Road Rake.* A. Daggett, Strong, Me. Comprises a wheeled vehicle, a rake suspended therefrom and composed of rails having perforations extending at an angle to the vertical, spring-teeth secured in said perforations, and means for raising and lowering the rake.

555,944. *Street Sweeper.* Thomas Ferry, Wilmington, Del. The combination of a brush, a receptacle, and an inclined apron between the two, that is slotted or open for the free passage of material the lower edge of said apron co-operating with the brush to guide material swept by the latter.

555,473. *Street Sweeper.* H. L. Carpenter, Minneapolis, Minn. The combination of a suitable wheel-frame, a brush extending across the same, a boot of the same width as the length of the brush, a conveyor extending forward of said boot, and narrower than the same, and laterally-operating brushes to sweep from the outer ends of said boot to said conveyor.

555,006. *Treatment of Sewage and Ventilation of Drains.* F. B. Hill, London, England. The combination with a flushing tank, of a receptacle for a disinfecting substance, and a displacing device consisting of an inverted air-holder or bell in said receptacle, an inverted air-holder or bell in the tank, and a pipe connecting the upper ends of said holders or bells.

555,015. *Tubular Frame for Bridges.* R. Mannesmann, New York, N. Y. An elastic tubular frame for a bridge consisting of longitudinal elastic seamless tubes of steel, and seamless elastic tubular bracing angularly interposed between said tubes, and clamping or securing bands of metal clamped upon and encircling the said tubes and the angles or bends of said tubular brace.

555,487. *Closed-Conduit Electric Railway.* C. Anderson, Leeds, England. The combination, with an underground conductor, of vertically movable contact pegs adapted to complete the circuit between the conductor and a car, a ramp carried underneath the car, and mechanism operated by said ramp for raising and depressing said pegs to make and break the circuit.

A BIG DEAL IN PHILADELPHIA.

The Vulcanite Paving Company of Philadelphia, the largest asphalt paving company in that city, has been absorbed by the Barber Asphalt Paving Company. Mr. C. A. Porter, one of the principal stockholders of the Vulcanite Company, has been anxious to retire from business and this is said to be the chief cause of the merging of the two companies. The basis on which the deal is reported to have been made is that stockholders in the Vulcanite Company will receive for each 100 shares of stock $1,500 in cash, bonds for the same amount and four shares of stock in the Barber Company, which will put a value of about $40 on each share of Vulcanite stock. The deal involves a sum in excess of $2,000,000. The paving contracts of the Vulcanite Company in Philadelphia have aggregated many millions of dollars. Dr. Ludwig S. Filbert, president of the Vulcanite Company, says regarding the deal: "I will remain a salaried officer of the company, and all stockholders will be protected. Those who do not wish to sell their stock need not do so, and those who wish to sell can get $40 a share. The object of the arrangement is to protect the stockholders and to place the business in the hands of experienced people who have been friendly in the past. I shall die some time, and when I do I want to know that the business is in safe hands. There will not be a single change so far as Philadelphia is concerned, and not a scrap of paper will be altered."

CLIMAX ROAD MACHINERY.

The Climax Road Machine Co., of Marathon, N. Y., have issued their ninth annual catalogue for road builders. It is very freely illustrated and the space given to this feature prevented the publication in the catalogue of the usual testimonial letters, but the company announces that it will send to all requesting it a list of those using their machines. In the introduction of the catalogue the company says: "During the eight years since the Climax first made its appearance before the public, we have fully realized the truth of the saying that 'There is no royal road to fame.' Only patient, persistent and intelligent effort can bring satisfactory results. That we have not been sparing of such effort is demonstrated by the fact that to-day we can point with pride to our road machine and stone crusher standing without peers in the ranks of road machinery. All defects which marred the efficiency of our machines in the early days of their manufacture have been corrected, all the weak points have been strengthened and we are constantly adding new improvements. We make no claims for our machines which we can not fully substantiate. Having the best of facilities for the manufacture of our goods, we are confident of our ability to quote as favorable prices, when quantity is considered, as any competitor."

PRICE OF STEAM ROAD ROLLERS.

Bids recently submitted on steam road rollers by some of the companies have been at a uniform price

of $3,500, and the question, therefore, presented to contemplating purchasers was the choice of rollers at this price. In a few instances there has been a refusal to purchase at all and the charge is made that a combination of four of the steam roller companies has been formed. Bids submitted recently to the Indianapolis board of public works by the O. S. Kelly Co., the Pitts Agricultural Works, the Harrisburg Foundry and Machine Works and the Aultman Co. were each $3,500. The board says that it will make an investigation for the purpose of ascertaining if there is a combination before accepting any of these bids. Mr. J. B. Cartmell, of the O. S. Kelly Co., when asked about the reports of the formation of a combination, replied that he would not discuss newspaper reports on the subject.

TRADE NOTES.

Rushford, N. Y., contemplates the purchase of a stone crusher.

The purchase of a new stone crusher is contemplated at Lowell, Mass.

The purchase of a stone crusher is contemplated at New Hartford, N. Y.

There is some talk of purchasing a steam road roller, at Spokane, Wash.

The Cincinnati Bridge Company, Cincinnati, Ohio, has been incorporated.

The board of public works, Spokane, Wash., will purchase a rock crusher.

The offices of the Crown Fire Clay Co., Canton, O., have been moved to Akron.

The purchase of a street sprinkler is contemplated at Fargo, N. D., by the street committee.

The question of purchasing a steam road roller is again being discussed at Union City, Ind.

J. W. Penfield & Son, Willoughby, O., have purchased an interest in the Haight Continuous Kiln.

The Brooks Street Sweeper Mfg. Co., Scranton, Pa., has been incorporated with G. M. Hallstead treasurer.

Sealed proposals will be received at Easton, Pa., until April 2, for a steam road roller. H. R. Fehr, city engineer.

The street committee of the council, Oberlin, O., has purchased a street sweeper and steel plow of the Austin Co., of Chicago, for $400.

The Universal Street Sweeping Machine Co., with chief business location at Boston, Mass., is reported as having made an assignment.

The purchase of a steam road roller and a stone crusher is contemplated at Wareham, Mass., $6,000 having been voted for that purpose.

The Marquis Brick Co., New Castle, Pa., contemplate a number of improvements at their plant, including the putting in of new machinery.

The Claflen Paving and Contracting Co. has been incorporated with offices in Denver, Colo., by H. M. Claflen, W. B. Page and John Coon.

C. A. Ballou, city engineer at Danville, Va., says that no action has been taken towards the proposed purchase of a road roller or street sweeper.

A. J. Sullivan, city clerk at Coffeyville, Kan., would like prices on a six-ton road roller, at once. The city may purchase other machinery a little later on.

The Cumberland Hydraulic Cement Works, Cumberland, Md., has resumed operations.

Totten & Hogg, Pittsburg, Pa., have a contract with the Ironton Structural Steel Company, of Duluth, Minn., for two reversing engines and a special train of rolls.

The new plant of the Monmouth Mining and Manufacturing Company, Monmouth, Ill., has been equipped with new machinery, and its capacity increased 25 per cent.

The Kalamazoo Foundry and Machine Company, of Kalamazoo, announce a reduction in the prices of their adjustable trenching braces, for which they also claim special merits.

Bids will be received, at Mobile, Ala., until April 9, for furnishing cement, gravel, etc., at McGrews Shoals landing, Tombigbee River, Ala. Maj. Wm. T. Russell, U. S. engineer.

The Standard Asphalt Company has been organized at Buffalo, N. Y., by John R. Hazel, Edward C. Shafer, Henry P. Burgard and Frank J. Illig, with a capital of $100,000.

The Union Paving and Contracting Co., San Francisco, Cal., has been incorporated by Joe H. Davidson, C. S. Harney, Daniel Harney, Alva B. Clute and D. H. Whittemore.

David Ramsey, street commissioner at Sedalia, Mo., says the city contemplates buying a road grader, and would like to have cuts and prices, and kind of guarantee that will be given.

A committee consisting of Franklin Jaquith, Thomas Spalding and Martin Conway, Sr., has been appointed at Billerica, Mass., to inquire into the matter of purchasing a stone crusher.

M. C. Taft, city engineer at Kalamazoo, Mich., says that the city has purchased a rock crusher, road machine, and a horse roller weighing five tons, which can be weighted to seven tons.

The Barr Clay Co., Streator, Ill., succeeds the Anderson & Barr Clay Co., and will continue the manufacture of paving and sewer brick. Mr. C. C. Barr, formerly of Anderson & Barr, is president.

The Mylar Asphalt Co., San Francisco, Cal., has been incorporated by Isaac Mylar, T. J. Mylar, and Clara Myler, of Loneoak, and Etta Livingston and Henry D. Livingstone, of King City, Cal.

The city council at Quincy, Ill., has instructed the mayor to correspond with the manufacturers of road rollers, excepting the Pitts Agricultural Works and the O. S. Kelly Co., with a view to purchasing.

The Collins Brick Co., Grand Rapids, Mich., has been incorporated to make brick, drain and sewer tile, and other clay goods. Joel Collins, Hiram Collins and Charles F. Collins are the incorporators.

The Eastern Paving Brick Co., Perth Amboy, N. J., has been incorporated to manufacture brick, tile, sewer pipe, etc. Directors, R. C. Penfield, New York city; Geo. D. Beattys, Brooklyn; W. W. Wallace, Willoughby, O.

The Anchor Paving Co., Evansville, Ind., has been incorporated by Peter Emrich, J. W. Gleichman and Louis A. Daus. A general paving business, together with the purchase and sale of paving brick, sand, etc., will be carried on.

The Standard Cement Company, Laramie, Wyo., has begun the

erection of a cement factory. The officers of the company are: President, Wm. Reese; vice-president, George W. Clark; secretary, S. M. Scott; treasurer, George W. Breidenthal.

The Empire Contracting Co., Syracuse, N. Y., has been incorporated, at Syracuse, N. Y., to conduct a general contract and improvement business. John Dunfee, Thomas Merriam, Hamilton S. White and John L. King, compose the company.

The Toronto Fire Clay Co., Toronto, Ont., has been incorporated by Edward Nicholson, Steubenville; Harry Nicholson, Toronto; Charles Rosser, Bellaire, and J. H. McCardy, Braddock, Va. Brick, sewer pipe and other clay products will be manufactured.

The Satterthwaite Contracting Co., Camden, N. J., has been incorporated to grade, pave and macadamize streets, roads, etc. James Satterthwaite, John L. Hallowell, Edwin Satterthwaite, Jr., Jenkinton, Pa.; Newton B. Smalley, Plainfield, N. J., and others, are stockholders.

The Standard Paving Co. has been incorporated at Newark, N. J., for a general contracting business, construction and erection of buildings, paving, etc. Wm. W. Schouler, Glen Ridge, N. J.; Wm. H. Turrell, South Orange; Wm. D. Gibby, Newark, are the stockholders.

The Standard Paving Company, the new company in Buffalo, has purchased the plant of the Buffalo Paving Company. The Standard Paving Company has elected officers as follows: President, Edward C. Shafer; vice-president, Frank J. Illig; secretary, Henry P. Burgard; treasurer, George Sandrock.

Sealed proposals will be received until April 24, at LaCrosse, Wis., for furnishing a 30,000 pound steam road roller, with plow, spikes, drag and all appurtenances. The machine is to be tested on the streets at La Crosse between May 1 and 20, at the expense of the manufacturers. John M. Vechota, deputy comptroller.

A paper brick has been patented by W. P. Emery, of Topeka, Kan. It is made of straw and wood pulp, is one-third the weight of an ordinary clay brick and can be made at half the cost. The inventor claims that with the wheat straw that annually goes to waste in Kansas he can pave the streets of every town in New Englrnd.

The Oak Orchard Harbor City and Improvement Co., Long Branch, N. J., has been incorporated by Ernest W. Emmons, Long Branch; Wm. H. Bridgeman, Brooklyn, N. Y.; Warren P. Bell, Passaic, N. J.; Wm. M. Wolfe, New York city. The company will build surface and elevated street railways, electric light and power plants, water-works plants, etc.

The Washington Fire Clay Co., Little Falls, Wash., has been reorganized, as follows: President, C. P. Masterson, Tacoma, Wash.; vice-president, Edwin Cookingham, Portland, Ore.; secretary, Joshua Peirce, Tacoma; general manager, Walter S. Bowen, Tacoma. The plant will be put in operation at once, and sewer pipe, vitrified paving brick, fire brick, etc., will be manufactured.

Engineer Van Alstyne, in charge of a corps of surveyors in the section of the canal at Lockport, N. Y., has found a piece of rock which he thinks is asphalt. When heated the substance gave off an odor not

unlike that of asphalt. The stone will be analyzed. Mr. Van Alstyne thinks there may be a small pocket where the specimen was found, which would be of no commercial value, as it is only a small deposit.

It is publicly charged in Chicago that a fund of $100,000 has been raised to influence the passage of an ordinance by the council of that city requiring the exclusive use of stone in sewer building. A committee, consisting of D. V. Purington, W. H. Alsip, A. Prussing and Bernard Weher, has been appointed by the Chicago brick manufacturers' association to investigate the charge, and a statement has been published in behalf of the committee affirming that it is true. It is estimated that if brick should be used in the construction of sewers, in accordance with the original plan, a hundred millions would be required for the work.

Mr. S. H. Finley, C. E., Santa Ana, Cal., says, that the company which has been operating a horse car line in the city of Santa Ana, Cal., for ten years, rather than perform their part of paving the streets, have recently forfeited their franchise and removed a portion of the track. The citizens have raised money and secured a three months option on the line running to Orange, a neighboring town, four miles distant. E. I. Tolle, a local machinist, has undertaken, at his own expense, to put on a noiseless steam motor that will be acceptable to the public. If he is successful the motor and road will be purchased at a stated price and operated by a new company.

New companies: Oak Orchard Harbor City and Improvement Co., Long Branch, N. J.; Eastern Paving Brick Co., Perth Amboy, N. J.; Anchor Paving Co., Evansville, Ind.; States Construction Co., New York City; Empire Contracting Co., Syracuse, N. Y.; Standard Paving Co., Newark, N. J.; Clearfield Clay Working Co., Clearfield, Pa.; Street Sweeping and Loading Machine Co., St. Louis, Mo.; Satterthwaite Contracting Co., Camden, N. J.; The Washington Fire Clay Brick Co., Little Falls, Wash.; Claflen Paving and Contracting, Denver, Colo.; Standard Asphalt Co., Buffalo, N. Y.; Brooks Street Sweeper Mfg. Co., Scranton, Pa.; J. E. Reilly Stone Co., Newark, N. J.; Union Paving and Contracting Co., San Francisco, Cal.; Toronto Fire Clay Co., Toronto, O.; Collins Brick Co., Grand Rapids, Mich.; Mylar Asphalt Co., San Francisco, Cal.; Elkins Brick and Tile Co., Elkins, W. Va.

The Columbus *Dispatch* states that on March 20th, the sheriff levied on the plant of the American Asphalt Company, at Marion, Ohio, on an execution issued by the common pleas court, for Anna Hallwood, wife of H. S. Hallwood, one of the principal stockholders. The amount of the execution was $7,621.25. The company had put down two pavements in Marion. The *Dispatch* says, "Coleman & Hallwood also put down two streets of brick, and H. S. Hallwood has the contract to pave South Main street and Delaware avenue, but the brick on South Main street have been attached to satisfy a debt of Dennis O'Connell, and those on Delaware avenue to satisfy a debt of James G. Fairbanks. Besides the execution taken on the asphalt plant, local creditors have all of the machinery and equipments of the plant attached." Mr. Hallwood says that the company will be able to meet all its obligations and that its financial embarrassment will be temporary.

LETTERS FOR THE PUBLIC.

NEW SYSTEM OF ROAD-MAKING IN GERMANY.

To the Editor of Paving and Municipal Engineering:

A new system of road-making is being employed in Germany, and has been introduced by one Otto Potsch, of Chemnitz. This system consists of a very simple process. Instead of the stones being squared on all sides, as is usually the case, only one side is squared and that, the upper; the building-in consists of artificial stone, made of sand and Portland cement.

By this mehtod not only is the cost of raw material reduced, but the evils incident to sand beds on which roads are often built, are avoided. In addition to that, the ramming and pounding is done away with, a greater elasticity is secured, and the long delays usually experienced in the building of roads is entirely obviated.

The mode of procedure is as follows: First, such stones are selected as may seem suitable for the kind of road to be built. These stones must be clean, for the reason that cement will have no hold unless the surface be clean. One side of each stone is squared; they are then placed upside down in a mold made either of wood or sheet iron, the sides of which ought to be previously smeared with pitch tar or some similar substance, in order that the cement may not stick to the sides. The interstices are then filled in with natural stones about one centimeter, equal to one-third of an inch in width; these are put in with the largest end down. Over these is poured a cement made of slowly hardening Portland cement or quickly hardening Roman cement; to this is added one and one-half to two parts clean, sharp, sifted sand.

The method of mixing this sand is to take clean water and cement, mix until pretty stiff; to this must be added the gravel previously wetted. The Roman cement will dry quicker, but will not be either as hard or as durable as the Portland.

The mold when filled should be allowed to stand twenty-four hours; they may then be removed, but should lay four weeks before being used.

Not only is the material thus produced very much better for all purposes for the reason of its elasticity and durability, but it is also easy to make, less liable to weather influences and is, withal, manufactured at a cost from one-third to one-half less than natural stone.

A. F. TENNILLE.

KENTUCKY BITUMINOUS SANDSTONE.

To the Editor of Paving and Municipal Engineering:

Your magazine comes regularly to hand and I am free to say that I think it a very valuable periodical. I think it improves with each number in its general news, containing a great deal of valuable information for those engaged in municipal work, and who are interested in paving and paving material. But it seems strange to me that while there are so many paving companies using so much asphalt, there are so few using our home product here in Kentucky, which certainly would be cheaper. In Chattanooga and other cities it has been subjected to very severe tests for several years with no appreciable wear. I know of a mine here of what is generally called bituminous sandstone and from all indications it is almost inexhaustible. Any responsible parties wanting to test its merits with a view of using it can get it in sufficient quantities by being at the expense of mining it. G. W. SMITH.

Guston, Ky., March 8, 1896.

COST OF RESURFACING ASPHALT STREETS IN BUFFALO.

To the Editor of Paving and Municipal Engineering:

We note in the Engineering News supplement March 12, 1896, page 82, under the head, "Repairing Asphalt Streets," Buffalo N. Y., that the bids for repairing run from $1.35 to $1.58 per square yard. It would be quite interesting to all brick men to know when this pavement was originally laid; what was the original cost of the pavement and how much has already been spent on repairs? Have you any way of getting at the facts in the case? E. S. GUNNELL, Agent.

Galesburg, Ill., March 23, 1896.

Mr. Gunnell's letter was referred by this magazine to Gen. S. J. Fields, the chief engineer of Buffalo, with a request for the facts bearing on the inquiry. Gen. Fields promptly replied as follows:

To the Editor of Paving and Municipal Engineering:

I inclose copy of bids received for repairing asphalt pavements. From results obtained here last year in repairing pavements by the skimming process I estimate that fully one-eighth of necessary repairs can be made in that way. Last year we paid 99c per square yard for that kind of work. The lowest bid for same work this year is at the rate of 88c per square yard. The bare statement of your correspondent that bids for repairing run from $1.35 to $1.58 per yard is very misleading. Asphalt pavements have been laid in this city since 1878 at an average cost of $3 per square yard. This price is for the pavement complete and includes curbstones and one foot of excavation. The average cost per annum for maintenance of asphalt pavements out of guaranty has been 5c per square yard in this city. The further use of the skimming process will probably reduce this average cost materially. S. J. FIELDS,

Chief Engineer.

Buffalo, N. Y., March 27.

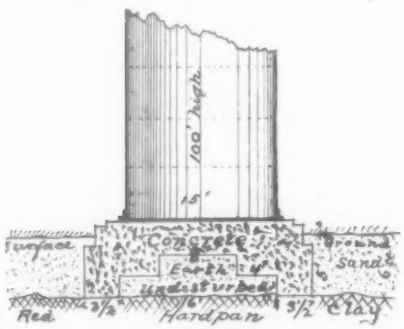
The bids referred to in Gen. Fields's letter were submitted by the Standard paving company, the Barber asphalt paving company and the German Rock asphalt and cement company. They covered six specifications of work, the lowest bids on which were by the Standard paving company, as follows: (a) For surfacing (by which the entire asphalt surface is to be taken out to the concrete and is to include all the work

necessary except the repair of the concrete), per square yard, $1.35. (b) For skimming where only part of the wearing surface is removed and replaced by new material, per square yard, 88 cents. (c) For replacing concrete and asphalt surface (including removing and replacing spongy earth where necessary), per square yard, $2.25. (d) For scraping joints between curb and pavement and for coating gutters twelve inches wide with pure hot asphalt and smoothing with hot smoothing irons, 3½ cents. (e) For cleaning out cracks, pouring them with pure hot asphalt and smoothing with hot smoothing irons, per lineal foot, 2 cents. (f) For replacing stone along street railroad tracks, between tracks and asphalt pavement, with concrete base and pouring joints of same with bitumen and making the asphalt connection between stone and asphalt, per lineal foot, 17 cents.

THE MADISON (Fla.) WATER WORKS.

To the Editor of Paving and Municipal Engineering:

The supply for these works is taken from a bored well 530 feet deep and six inches in diameter, which is sunk at the top of the hill upon which the town of Madison is built. The well is sunk first through the red clay and sands of the Lafayette series, which resulted from the denudation of the Appalachian Chain, and then passes through the rotten limestone which characterizes the Eocene formation into the more solid lime rock of the Miocene. In passing through the Eocene the drill dropped through a cavity of about twelve feet in depth and of unknown lateral extent.



The water, which is believed to come from the Miocene strata, is very clear and is found to be well adapted to steam boilers. The water in the well stood at a depth of 117 feet below the surface before the pumping commenced, and was lowered to 123 feet immediately after the pumps commenced work, and subsequently became lower at times.

A Pohle air lift-pump, having a capacity of only 100 gallons per minute, down pipe four inches in diameter, up pipe three and one-half inches, is used, which raises the water from the well and delivers it into a brick-pump-well at the surface of the ground.

From here it is pumped by a duplex pump, having a capacity of 300 gallons per minute, into a stand-pipe 100 feet high and 15 feet in diameter, made of the best boiler iron and erected in the Court House lot in the center of the town. A by-pass and check valves are provided at the base of the stand-pipe. There are three and one-half miles of cast iron distribution pipe, from twelve to four inches in diameter, and one special pipe for the railroad two inches in diameter. There are forty-eight gates, thirty crosses, thirty tees, thirty-one six-inch hydrants and twenty reducers. The hydrant branches are all four inches.

Owing to numerous failures of steel stand-pipes in different parts of the country, and the difficulty in obtaining steel of a homeogenous quality, it was deemed safer to use the best boiler iron.

The stand-pipe is a plain cylinder and is erected on the Court House lot, in the center of the town. The original estimate for the stand-pipe was $2,522.91, without foundations. The amount paid was $2,590. The original estimate for the entire water works was $19,192.22, which included a tank and steel tower. The specifications were afterward modified to include a stand-pipe instead of tank and tower.

The engineer's estimate by this plan, with stand-pipe, of the complete works, was $13,469.26. The contract was let to Herbert & Lapaye, of Chattanooga, Tenn., for $13,700.

The specifications for the thickness of the stand-pipe, which was of boiler iron, were as follows:

Engineer's Specification.	Stand-pipe, as built.
Bottom, ¾ in.	Bottom, ½ in.
20 ft. ¾ in.	10 ft. ½ in.
20 ft. ¾ in.	10 ft. 7-16 in.
20 ft. ⅝ in.	30 ft. ⅜ in.
20 ft. ½ in.	30 ft. 5-16 in.
15 ft. 7-16 in.	20 ft. ¼ in., top.
5 ft. ⅜ in.	———
5 ft. 5-16 in.	100
5 ft. ¼ in.	
10 ft. 3-16 in., top.	
———	
100	

Top to be ringed with angle iron, 2"x2"x4 lbs., on outside. Two other angle iron rings were provided to stiffen the stand-pipe between the top and bottom outside, and two at the bottom. Those were not put on. The committee on water works assumed the responsibility of the above change against the protest of the engineer.

The water in the deep well is lowered forty or fifty feet as soon as pumping is commenced.

The accompanying section shows the form of the foundation, which was round. The stand-pipe was anchored to it by 8-2x8-ft. bolts. The foundation consisted of concrete of the following preparations: one-eighth part clear American cement; one-eighth part fat lime paste; two parts sharp, clean sand; five parts screened gravel or broken stone. The mortar for the brick work is composed of one part best Alsen's Portland cement; one part fat lime paste; four parts sharp, clean sand

JOHN FRANCIS LE BARON,
M. Am. Soc. C. E.

Jacksonville, Fla.

MUNICIPAL REPORTS.

MINNEAPOLIS, MINN.—City Engineer Cappelen's annual report is a full and complete review of the work under his supervision, embracing statistical information, maps and photographic views. In reviewing the paving of Nicollet-ave. last year with Wasatch lime rock asphalt, where it was used for street paving for the first time east of the Rocky mountains, he gives the following as the proportions of the paving mixture:

Residuum oil	14 per cent.
Pittsburg flux	54 per cent.
Pure asphaltum gum	32 per cent.
Total	100 per cent.

This formed the matrix of which about 105 pounds were mixed with 150 pounds of pulverized Wasatch lime rock asphalt and 745 pounds of sand. The oil was tested to 270 degrees, the gum then added and heated to 415 degrees for about eight hours. The sand was heated to 450 degrees and the Wasatch was added. The average temperature of the mixture on the street was 340 degrees.

Mr. Cappelen thinks the present street sprinklers throw too much water for asphalt pavements and suggests that they be changed to throw only a spray. He speaks with satisfaction of a trial of the "Boss" street scrapers on Hennepin and Nicollet-aves. This scraper is really nothing but a large dust pan on two wheels so that it can be easily run and turned in any direction. The operator pushes it along the paving, the sharp edge of the scraper catching the dirt, which is, with the assistance of the operator's broom, pushed into the pan and removed to the curb line, from where it is hauled away. When the steel edge wears off it is renewed.

Mr. Cappelen tried the washing of asphalt streets by the use of fire hose attached to hydrants. The cost of washing 32,455 square yards per morning was—four men three hours at 15 cents per hour—a total of $1.80.

Mr. Cappelen speaks with favor of the brick paving done last year, when Purington repressed and three other kinds of brick were put down, the price f. o. b. in Minneapolis ranging from $14 to $15.75 per thousand. He expresses the hope that the National Brick Manufacturers' Association will soon report a standard of tests and specifications for paving brick. He says regarding the further use of brick: "I think that I can fairly state that brick will answer the purpose for quite a number of our streets, particularly if the vitrified brick industry could be developed in near proximity to Minneapolis so as to cut the cost of brick pavements down to $1.25 or $1.30 per square yard."

Mr. Cappelen recommends the paving of a number of streets this year, aggregating in area 137,612 square yards, "with something better than cedar," and asks the council to determine at an early day what material shall be used.

It is the practice in Minneapolis to invite proposals for cement and to purchase from the lowest bidder who can furnish a brand that complies with the specifications. He recommends that hereafter no purchase be made from a bidder who does not have storage facilities for at least a few carloads of cement. He also recommends the purchase of testing machines for the purpose of making tests on a larger scale. The most important work of the year was the construction of the water works reservoir, and much of Mr. Cappelen's report is devoted to details of this.

MUSCATINE, IA.—The first annual report of Mr. Walter M. Hay, city engineer, shows that the principal work done in Muscatine during 1895 was 2.71 miles of brick paving, together with 4.6 miles of sidewalks, costing $16,000, and sewers costing $26,804. He recommends a system of street cleaning and sprinkling. A plan of utilizing jail prisoners for sweeping the streets was tried in 1895 and was found to be more expensive than sweeping by machines. Mr. Hay recommends the purchase of equipment for brick and cement tests.

PEORIA, ILL.—The paving work in Peoria last year comprises 79,905 square yards of brick, costing $124,217.86, and 30,351 square yards of asphalt, costing $72,822.09. The work contemplated for the season of 1896 comprises 83,300 square yards of brick at an estimated cost of $158,999.57, and 39,026 square yards of asphalt at an estimated cost of $105,169.70. More permanent improvements were put down in place of 15,126 square yards of cedar block, 26,160 of gravel and 8,466 of cobblestone. The report of Mr. A. D. Thompson, city engineer, says that concrete foundation for paving will continue to be used, as it was last year. "There has been considerable discussion," Mr. Thompson says "relative to the admission of gravel as an ingredient of the concrete, in addition to broken stone, the claim being advanced that concrete made of gravel is just as strong and can be laid cheaper than concrete composed of broken stone. This question was carefully considered before the ordinances and specifications were drawn up, and, after a thorough investigation of the character of the gravel in this neighborhood, it was deemed inadvisable to allow concrete to be made of gravel. A good, clean gravel, with the particles uniformly ranging from the size of a pea to two inches in diameter, will produce a concrete which is strong enough to fulfill all the requirements of a foundation for pavements. There is a large quantity of gravel of proper size in this vicinity, but it is filled with clay and foreign matter, making it necessary to clean same by washing before it is fit for use in concrete. If this gravel is not cleaned, the coating of dirt and clay surrounding the particles of stone prevents the adhesion of the cement to same, and the strength of the concrete is measured by the adhesive strength of the dirt to the stone. During the operations of washing, the particles arrange themselves in the order of size, there being a batch of large particles at one time for the mixture, and a batch of small particles for the next, thus destroying the essential repuirement

for a high strength, namely, that the particles be uniformly ranged, so that the voids shall be small and well filled, and the concrete compact and solid. I do not know of a single instance in which this difficulty has been overcome in a satisfactory and economical manner, although several ineffectual and costly attempts have come under my observation."

Changes have been made in the brick paving specifications with the object of producing a more durable and smoother pavement. The proportion of broken stone in the concrete has been reduced from five to four parts, and the top of the concrete is required to be broomed to a smooth surface. The sand cushion has been changed from one to two inches, with the belief that the thicker cushion will produce a smoother and less noisy pavement. Paving blocks 3x4x9 inches will be allowed in competition, under strict test requirements, with bricks 2½x 4x8 inches, instead of requiring only the small size.

Mr. Thompson expresses dissatisfaction over the uncertainty "attending the quality of asphalt necessary to produce the best results," and asks that facilities be provided for thorough tests of materials, provided for through tests of materials, obviate the uncertainties as to results, as well as open the way for better and cheaper pavements.

Mr. Thompson says that plans are now being prepared for three important sewer systems.

YONKERS, N. Y.—The report of Samuel L. Cooper, commissioner of public works, has been completed for the year ending March 1, 1896. The length of the sewers built has been 7,019 lineal feet, making a total of 30.852 miles of sewers in the city; the area of macadam streets and roads was 107,509 square yards, making a total of 8.59 miles. The estimated revenue for the department for the coming year is $55,098.56, which amount, the commissioner thinks, is inadequate for the work required and expected of the department. He says: "In the last three years over $300,000 has been expended on macadam streets and roads. The nature of our topography is such that storms do great damage on many of our highways. It is surely extravagance to withhold sufficient means to repair these damages before general destruction ensues. The amount available for the coming year will make street reconstruction impossible from the department of public works fund, and the whole amount will have to be spent in maintenance alone."

NEW BEDFORD, MASS.—The board of public works, in its annual report, expresses the opinion that the city is behind in the matter of paving, and that a large and constantly increasing use of asphalt in other cities proves that this pavement has passed the experimental stage and more nearly reached the wants of the community than any other. The amount of macadam laid during last year exceeds that of any previous year, yet there is an immense amount of work to be done and it will require the most persistent efforts for years to bring the streets to the proper standard. An increased amount of block paving has been done during the year; upon the advice of the acting superintendent several thousand blocks have been laid upon a concrete foundation and pointed with cement. "This manner of laying blocks is in general use in all large cities, and while the cost exceeds that of the method heretofore in use in this city, i. e., upon a foundation of sand, we believe with the superintendent that the advantage of having a surface that is uniform and consequently more easily cleaned and of longer durability far outweighs the additional cost."

The superintendent, in his report to the board, says the most important item of street improvements has for many years been, and no doubt will continue to be, the macadam work. With the new crusher plant completed and ready for use, and with two first-class steam road-rollers, a large amount of work can be done. During the year 12,000 feet of curbing was laid, and the superintendent says "no improvement the board can make seems to meet more with the approval of the citizens generally. In view of the continued demands, I would recommend that a large amount of curbing be laid the coming season."

The total amount of sewers constructed during 1895 exceeds by about 5,000 feet the amount built during 1894.

The superintendent of parks, in his report, recommends several improvements.

PORT HURON, MICH.—In submitting the first annual report that has been asked from his office, F. F. Rogers, city engineer, says that previous to 1891 there were less than eight miles of sewers in Port Huron. Since that date twenty-one miles have been built. At present Port Huron has twelve miles of cedar block and brick pavements, about 45 per cent. of which has been renewed or first built within the past five years; of this amount 5,562 square yards are brick on concrete foundations.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Erie, Pa.—California asphalt has been admitted to competition for paving State-st.

Quincy, Ill.—(Special.)—E. R. Chatten, C. E., says no definite action has been taken on the proposed street improvements.

Scottsburg, Ind.—(Special.)—S. B. Neels, town clerk, says the contract for macadamizing will be let to contractors under the Barrett law.

Galt, Mo.—(Special.)—Thomas Fleshman, city clerk, says that it is not probable that the city will make any improvements this year.

St. Paul, Minn.—The final order for paving Fifth-st. with asphalt failed to receive the necessary two-thirds vote, and it will not be paved this year.

Galveston, Tex.—(Special.)—G. Bowden Little, clerk of board of public works, says that no municipal improvements are contemplated for the immediate future.

St. Louis, Mo.—Commissioner Milner approves the placing of asphalt over macadamized streets. He also favors vitrified brick for streets not given over to heavy traffic.

Omaha, Neb.—It is estimated that during the next three years this city will lay twenty-two miles of asphalt paving in replacing wooden pavements and in original paving of streets.

Alpena, Mich.—(Special.)—W. O. McDonald, recorder, says that the reports of contemplated municipal improvements are erroneous. The city has no improvements in view for the ensuing year.

Buffalo, N. Y.—The Standard paving company, a new competitor in asphalt paving, has made its appearance here. It is composed of Edward C. Shafer, John R. Hazel, Henry P. Burgard and Frank J. Illig of this city.

Petersburg, Va.—(Special.)—T. R. Dunn, C. E., says: "Nothing definite has been done by our city authorities in relation to the brick pavements; however, we hope to be able to inaugurate a system of improvements at an early date, when I will inform you."

La Crosse, Wis.—A communication was presented at a meeting of the common council, March 13, from Thomas Simpson, of Winona, on that city's experience with brick paving, in which he said: "We laid, two years ago, several miles of brick pavement in Winona, the only pavement we ever had. It cost, laid complete, $1.44 per square yard. We used brick from Galesburg, Ill. It is as near a perfect pavement as can be laid and is beyond criticism. No other kind of pavement will ever be laid in this city. Our city officials spent many weeks in the examination of all kinds of pavement in all the cities of the Mississippi valley, including Indiana and Ohio, and settled on brick, and after two years' trial all are fully satisfied. Upon inquiry of the construction company who laid the pavement here, I learn it can be laid some cheaper now; brick is $2 per thousand less than two years ago. The curbing stone, 6 by 20 inches, costs 53 cents per lineal foot."

Corry, Pa.—Messrs. G. H. Barnes, Nathaniel Stone, W. C. Shields, C. S. Crandall, Charles Porter, George Thomas and E. D. McKinsie were appointed a committee to visit Jamestown, N. Y., to inspect the street pavements and the Shale paving brick works for information preparatory to paving streets in this city this spring.

Wilmington, Del—Samuel Chambers, director of the street and sewer department and William Simmons and William Pratt, city engineer, visited Pittsburg, Toledo, Canton, Columbus, Athens and other places, to investigate the use and manufacture of paving brick. The party left this city March 21.

Atlanta, Ga.—An order has been granted by Judge Lumpkin enjoining the city four collecting paving assessments from property-owners on Butler-st. Butler-st. was paved with vitrified brick for the benefit of Grady hospital, and the residents of the street objected to being assessed for their portion of it.

Los Angeles, Cal.—There is talk of another injunction suit that will probably be brought to test the validity of the proceedings in the matter of the Main-st. paving. In the meantime the impression has gained ground that the suit now on file to restrain the work has been brought in the interest of the contractor.

Jackson, Mich.—The special committee appointed by the board of public works to investigate the merits of various paving brick visited Toledo, Canton, Cleveland and Detroit for that purpose. The Canton Shale were among those most highly recommended to the committee. The board of public works resolved, however, that nothing had appeared that warranted discrimination against home-made brick, and Jackson brick will probably be used by Contractor Brooks.

Bradford, Pa.—An ordinance was passed some time ago by the council providing for the paving of Main-st., from the Erie tracks to E. Main-st., and a petition was made to the court by City Solicitor Brown for the appointment of viewers to assess damages in accordance with the new law under which the ordinance was framed. Attorneys Berry and Edgett, on behalf of the propert-owners, opposed the appointment, contending that the law was unconstitutional and the ordinance illegal. Judge Morrison has decided the case in favor of the city and the court will appoint viewers.

Elkhart, Ind.—In the Jackson-st. pavement injunction suit brought by W. T. Wickwire and others to restrain the city from work, averring that the action of the council in not awarding the contract to the lowest and best bidder was invalid, and which the circuit court decided was not sufficient trial of the case, has been sent back to the circuit court by a supreme court decision.

Savannah, Ga.—Commissioner of Public Works Willink, who visited Jacksonville, Fla., recently to inspect the brick pavements in that city, says: "The brick pavements do not show any indications of wear and appear to be as good as when first laid. I saw some brick that were taken up in making an excavation and there was no appreciable wear. The pavement makes a smooth surface and one that can be easily cleaned."

Hazelton, Pa.—(Special.)—Mr. A. Brooks Celiax, city engineer, recently submitted to the common council of Hazelton a voluminous report of information regarding street paving in neighboring towns of similar conditions. He reported that in Easton, Wilkesbarre, Scranton, Carbondale, Pittsburg and Altoona the cost of brick paving ranged from $1.70 to $2.43 per square yard, and for asphalt from $2.49 to $3 per square yard. He recommended asphalt and brick as possessing more of the desirable qualities than other materials.

Springfield, Ill.—Mayor Woodruff, Charles M. Rickard, city engineer, John Patteson, superintendent of streets, and Ed White of the city engineer's office made an examination, March 6, of the concrete base on which the brick pavement is laid in a number of streets. A force of laborers preceded the party and took up the brick pavement in widely scattered portions of the city. The mayor and city engineer were well pleased with the tests and declared the work well and satisfactorily done, and that the concrete base would outwear the brick paving.

Ft. Wayne, Ind.—Some new methods will be introduced in the specifications for street paving. Heretofore on all streets on which brick was used the brick was laid in a position parallel with the lateral streets, which is said to cause more jolting in vehicles than if the brick were laid at an angle of forty-five degrees, and causing the pavement to wear away more rapidly. It has also been customary to demand the deposit of a certified check with the contractors' bid, usually $25, to insure the cost of advertising in case he should not fulfill the stipulations, and that it should become necessary to call for new bids. The specifications will call hereafter for laying the bricks on an angle at street intersections and demand a larger deposit.

CONTEMPLATED WORK.

Alexandria, Ill.—Harrison-st. will be paved with brick.

Toronto, Canada—This city contemplates some brick paving.

Council Bluffs, Ia.—Brick paving for Pearl-st. is contemplated.

East Orange, N. J.—Asphalt is recommended for paving Main-st.

Pueblo, Col.—Plans have been ordered prepared for paving Main-st.

Wilkinsburg, Pa.—Rebecca, McKean and Kelly-sts. will be paved.

Arcola, Ill.—The graveling of the Springfield road is contemplated.

Martinsville, Ind.—Brick paving is being considered for the public square.

Niles, O.—Plans and specifications have been prepared for paving Main-st.

Dayton, O.—Xenia-ave., from Samuel-st. to Van Cleve-ave., will be paved.

Nevada, Mo.—A vitrified brick pavement is contemplated for Cherry-st.

Orleans, Ind.—The question of macadamizing roads is being investigated.

South Bend, Ind.—E. Water and E. Jefferson-sts. will be paved with brick.

Utica, N. Y.—Genesee-st., from Baggs's square to Blandina-st., will be repaved.

Atlanta, Ga.—Asphaltic paving is contemplated for Capitol and Auburn-aves.

Palmyra, Mo.—A gravel road is contemplated from the Hollyman farm to this city.

La Grange, Ill.—Paving is proposed for all of the streets on the North Side this year.

Boston, Mass.—Sweet-st., Dorchester, will be paved with granite blocks or macadam.

Lansing, Mich.—Resolutions have been passed authorizing brick paving for two streets.

Decatur, Ala.—The question of macadamizing the county roads is under discussion.

Allegan, Mich.—In his address Mayor Pope favors paving the streets within the fire limits.

Whitestone, N. Y.—The question of macadamizing the streets is under consideration.

Springfield, Mo.—The county court contemplates some extensive road improvements soon.

New Haven, Conn.—Bids will soon be asked for paving two streets with asphalt and two with brick.

Pueblo, Col.—Specifications have been ordered prepared for paving Main-st. C. E. Ross, City Clerk.

Pittsburg, Pa.—The schedule of streets to be repaved this year will require an expenditure of $205,000.

Jerseyville, Ill.—The paving of Pearl-st., between Main and Washington, with brick is contemplated.

Sandusky, O.—A declaratory resolution has been adopted for paving Market-st., from Jackson to Pearl.

Galesburg, Ill.—The paving of Cherry-st., from the Santa Fe tracks to Sanborn-st., is under consideration.

Dartmouth, N. S.—An asphaltic pavement, with cast iron curbing, is being discussed for Portland-st.

St. Louis, Mo.—Ordinances have been introduced for paving seven West End streets with vitrified brick.

Passaic, N. J.—An asphaltic pavement on Gregory-ave., between Passaic and Pennington-sts., is proposed.

Dubuque, Ia.—Grading and macadamizing has been authorized for eleven streets and flagging for five streets.

Scranton, Pa.—A plan of agitation for street improvements will be submitted to the South Side board of trade.

Jefferson City, Mo.—A proposition to issue $20,000 in bonds for street improvements is under consideration.

Decatur, Ind.—It is said that the farmers are becoming interested in the question of road improvement.

Sioux City, Ia.—The question of repairing Fourth-st. and intersecting streets with brick is under discussion.

Flushing, N. Y.—The proposition to macadamize Bell-ave., from Broadway to Willetts Point, will be voted on.

St. Louis, Mo.—Asphaltum or vitrified brick is being agitated for one and one-half miles of King's highway.

Kewanee, Ill.—(Special.)—Hugh Hill, city clerk, says that there will probably be no paving done this summer.

Monroe, Mich.—(Special.)—Joe Steiner, city clerk, says that no paving will be done that is known of at present.

Columbia, Mo.—The citizens will vote April 7 on the question of borrowing $15,000 for macadamizing the streets.

Tiffin, O.—Brick paving on broken stone foundation is contemplated for several streets. Robert W. Lyle, City Engineer.

Chicago, Ill.—A petition is being circulated for paving Jackson-st., from Michigan-ave. to the river, with asphalt.

Cincinati, 0.—Forbes alley, from Race to Plum-st., will be graded and paved with granite blocks and granite curbs set.

Fargo, N. D.—N. Broadway will be graded, curbed and paved. The probable paving of Eighth-st. is under consideration.

Decatur, Ind.—A petition has been presented to council by the property-owners along Fourth-st. for a macadam pavement.

Toledo, O.—A petition has been presented to the street committee for approval for paving Starr-ave., from Euclid-ave. to Oak-st.

Plattsburg, N. Y.—A bill authorizing this village to borrow $50,000 for street improvements has been introduced in the legislature.

Portsmouth, Va.—Estimates are being made by John W. Wood, street inspector, of the cost of paving Water-st., from High to County.

San Francisco, Cal.—The proporty-owners on Derisadero-st., between Waller and Thirteenth, have petitioned for bituminous rock paving.

Danville, Va.—(Special.)—C. A. Ballou, city engineer, says that no decision has yet been reached in reference to public improvements.

Chattanooga, Tenn.—The residents in Oak-st. will petition the city council to pave the thoroughfare from Georgia-ave. to the city limits.

Chicago, Ill.—Two petitions are in circulation for paving W. Madison-st., from Homan to Western-ave., one for asphalt and one for brick.

Milwaukee, Wis.—Property-owners on Third-st., from Grand-ave. to W. Water-st., are agitating the repairing of that street with asphalt.

Youngstown, O.—A resolution has been passed in council to pave or repave with asphalt or brick, or to surface with asphalt over the present brick pavement, Wick-ave., from Wood to McGuffey-st.

Marietta,O.—(Special.)—E. Frank Gates, city engineer, says plans have been made for 34,315 square yards of paving, which will be advertised soon.

Warren, O.—(Special.)—Homer C. White, city engineer, says bids will be advertised for in the near future for about one-half mile of asphalt pavement.

Marion, Ind.—A petition is being circulated by E. P. McClure, asking that the streets about the public square be paved with asphalt instead of brick.

Dubuque, Ia.—A petition will be presented to the county board asking the members to sign it for the county, urging the use of asphalt for Pearl-st.

Laporte, Ind.—About 14,000 square yards of brick streets are contemplated at a cost of $20,000; also six blocks of brick paving on broken stone foundation.

Kansas City, Kas.—Hallock-st., from Troup-ave. to Parallel-ave., and Third-st., from Kansas-ave. to Osage-ave., will be paved with vitrified brick and curbed.

Detroit, Mich. — Holbrook-ave. and Jefferson-ave. will be paved with cedar blocks on concrete, with Medina or North river blue stone curb and cross walks.

Plymouth,Ind.—(Special.)—Will E. Leonard, jr., city clerk, says that street paving is talked of, but there is some doubt as to what action the council will take.

Columbus, O.—A resolution was adopted March 2 to improve Parsons-ave., from Marion-ave. to the south corporation line. Estimates, $43,600.80; asphalt, $97,126.30.

New Bedford, Mass.—City Engineer Williams has been instructed to prepare specifications for laying asphalt blocks in Fourth-st., between Union and School-sts.

Columbus, O.—The improvement of the road leading from Grove City to Greenlawn cemetery is contemplated by grading the roadbed and covering it with crushed gravel.

Huntington, Ind.—A petition has been presented to council asking that Etna-ave., from Jefferson-st. to the corporation line, be paved with a first-class quality of asphalt.

Jersey City, N. J.—(Special.)—A. W. Ruggles, city engineer, says: "We are in doubt at the present time whether or not a great amount of work will be done this season."

Kalamazoo, Mich.—(Special.)—M. C. Taft, city engineer, says that nothing definite will be decided upon relating to municipal improvements for two or three weeks yet.

Atlanta, Ga.—(Special.)—R. M. Clayton, city engineer, says that the council has not yet decided upon the amount and character of the pavements that will be laid this year.

Helena, Mont.—A number of petitions for county roads have been favorably acted upon by the county commissioners, viewers having been appointed to report upon all but one.

Brooklyn, N. Y.—Resolutions have been passed by the board of aldermen ordering the paving of Park-ave., between Hudson-ave. and Broadway, with granite, at a cost of $113,000, and the paving of Hayward-st., between Bedford-ave. and Broadway, with asphalt, at a cost of $21,000.

Burlington, Ia. — (Special.) — William Steyh, city engineer, says no improvements will be ordered until after April, as the new board of aldermen will not be ready before then.

Muncie, Ind.—The city council decided March 23 to construct twenty-five additional blocks of Trinidad asphalt streets during this season. Work will probably begin soon after April 20.

Port Huron, Mich.—(Special.)—F. F. Rogers, city engineer, says that Military-st. will be paved with brick from Pine-st. to the Military-st. bridge, 4,276 square yards. The estimated cost is $7,954.10.

Portland, Ore.—There is evidence of the movement for repairing Third-st. being renewed. The improvement of Burnside-ave. may again be considered. Asphalt, brick and wood block will be considered.

Bellefontaine, O.—(Special.)—Jas. C. Wonders, city engineer, says there will be some street improvements consisting of stone or cement gutters, and macadam or gravel, and probably some brick paving.

Buffalo, N. Y.—(Special.)—M. M. Drake, commissioner of public works, says that petitions for street paving are being presented to the council weekly; also for sewers, but not for extensive contracts.

Springfield, O.—Estimates have been made by Assistant City Engineer D. F. Snyder for grading, graveling, curbing and guttering Western-ave., Broadway-st. and Greenmount, Bell, Ludlow and Shaffer-aves.

Albany, N. Y.—Madison-ave., between Lark-st. and Western-ave., will be repaved with vitrified brick within and between the outer rails and two feet beyond the rails and tracks, by the Albany railway company.

Detroit, Mich.—(Special.)—H. H. Stevens, secretary board of public works, says that no bids will be asked for brick and asphalt paving until further appropriations are granted, or unless petitioned for by property-owners.

McMinnville, Ore.—The board of trade voted March 11 in favor of the improvement of several of the principal streets of this city, also to confer with the county court in regard to graveling all the principal roads leading into the city.

Bloomington, Ind.—A vote will be taken April 20 in Richland and Bloomington townships, including the town of Ellettsville and that part of the city of Bloomington lying in Bloomington township, on the construction of gravel and macadamized roads.

Buffalo, N. Y.—Petitions have been favorably acted upon for paving Troup-st., from Seneca to the Union terminal tracks; Grace, between Niagara and the Erie tracks; W. Eagle, from Delaware to the Terrace; Schmarbeck, from Broadway to Schlenker.

Denver, Col.—Plans and specifications have been adopted for sand-stone curbing and Trinidad lake asphalt, Pacific asphalt paving cement, or Bermudez asphalt, for the following: Broadway, from Welton to Colfax-ave.; Colfax-ave., from Broadway to S. Thirteenth-st.; Cheyenne, from Broadway to S. Fifteenth-st.; Cleveland-place, from Broadway to Colfax-ave., and Sixteenth-st., from Cleveland-place to Broadway.

Minneapolis, Minn.—A petition has been presented to the city council by the chamber of commerce asking it to order Third-st., from Third to Fourth-aves., S., and Fourth-ave., from Third to Fourth-sts., S., paved with asphalt this year as early as possible.

Cincinnati, O.—An ordinance has been passed for macadamizing W. Eighth-st., from Elberon to Enright-ave., and setting curbs and crossings and flagging the gutters. Sycamore-ave., from Liberty-st. to Auburn-ave., will be bowldered with granite curbs, crossings and gutters.

Quincy, Mass.—(Special.)—C. F. Knowlton, commissioner of public works, says that petitions have been introduced in council and $30,000 asked for 10,000 square yards of granite paving and 4,000 square yards of macadam road; referred to committee on streets. The city will do the work

Ft. Wayne, Ind.—(Special.)—M. M. Smick, clerk board of public works, says that Wells-st. may be paved this season, and it is altogether probable that it will be paved with brick. Some of the residents on the street have presented a petition for asphalt, but the greater number prefer brick.

Newark, N. J.—Petitions have been made for paving Taylor-st. with brick and the northerly end of High-st. and S. Sixth-st. with asphalt. Notices of intention of paving thirteen streets with asphalt, brick and granite blocks have been published. An appropriation of $10,000 has been asked for curbing.

Pasadena, Cal.—The property-owners on Colorado-st., between Marengo and Los Robles-ave., have asked that necessary resolutions and proceedings be taken to start the work of paving that portion of the street with two inches of asphalt on a four-inch foundation, with cement concrete gutters three feet in width.

Hazleton, Pa.—(Special.)—A. Brooks Caliax, city engineer, says nothing definite has been done in the proposed street paving matter except a report which the board of trade made, reviewing answers which have been received from the officials of nearly a dozen cities and towns giving their experience with street paving.

Indianapolis, Ind.—Paving is contemplated as follows: Asphalt, Vermont-st., from Meridian to Pennsylvania; Senate-ave., from Washington-st. to Kentucky-ave. Brick, first alley west of Capitol-ave., from Vermont to Michigan-st.; Roanoke-st., from Vermont to Michigan; Court-st., from Senate-ave. to California-st.; Columbia alley, from Ohio to Michigan-st.; Alabama-st., from Maryland to the viaduct; Senate-ave., from Kentucky-ave. to South-st.; Kentucky-ave., from Missouri-st. to River-ave. Wood block, Vermont-st., from West to Meridian, and from Pennsylvania to East.; Michigan-st., from East to West; North-st., from Meridian to West, and from Ft. Wayne to East; Illinois-st., from Seventh to Fall creek. Cement walks, Lexington-ave., from Frank to State-st.; Jefferson-ave., from Washington to Michigan; Orange-ave., from N. Brookside-ave. to Keystone-ave.; Ohio-st., from Beville-ave. to Rural-st.; Delaware-st., from Tenth to Four-

teenth; Thirteenth-st., from Talbott-ave. to Central-ave.; Illinois-st., from Twenty-sixth to Thirtieth-st. Brick walks, west side Highland-ave., from Vermont to Michigan-st.; south side Irwin-st., from College-ave. to Bellefontaine-st.

Cincinnati, O.—Resolutions have been adopted for paving Buchanan-st., from Pike to Lawrence, with brick, and Holmes alley, from Broadway to Sycamore, with granite.

Dunkirk, N. Y.—(Special.)—D. F. Madigan, city clerk, says that as yet it is impossible to say what improvements in the line of pavements, etc., will be made the coming year, as the new council has not yet organized fully to do business. He also says that the purchase of road rollers, streets sweepers and other road implements is not contemplated.

Savannah, Ga.—S. Broad and portions of Abercorn and Habersham-sts. will be paved with vitrified brick. Commissioner of Public Works Willink, who is engaged in selecting the brick for the work, visited Jacksonville, Fla., recently to examine the brick pavements in that city and will visit other cities where brick pavements are in use before deciding upon any particular make of brick.

New York, N. Y.—Commissioner of Public Works Collis contemplates expending about $1,000,000 this year for asphalt pavements. The plans provide for asphalt on the east and west sides of the city. The west side will begin at Chambers and Hudson-st., along Hudson to Thirteenth, thence to Eighth-ave. The east side will be on First-ave., from Twentieth to One Hundred and Ninth-st.; Eastern boulevard, from Ninety-second to One Hundred and Sixth-st., and Madison-ave., from One Hundred and Twenty-fifth to the Harlem river.

CONTRACTS AWARDED.

Toledo, O.—North-st. will be paved with vitrified fire brick on a concrete foundation by Wm. McMahon for $1,861.14.

Ft. Wayne, Ind.—Currie & Conn of Detroit received an order from this city for a carload of cedar blocks at 30 cents per yard.

Waukegan, Ill.—John Cherry & Son of Jacksonville, Ill., was awarded the contract for laying two miles of paving for $34,000.

Grand Rapids, Mich.—The Warren-Scharf asphalt paving company secured the contract for paving Washington-st. for $11,424.

Allegheny, Pa.—W. E. Hawley of Pittsburg was awarded a contract, March 12, for 14,000 cubic yards of grading in this city for $3,320.

Akron, O.—The Holloway paving brick company, Canton, O., was awarded the contract for furnishing 1,100,000 paving brick to this city.

Waterloo, Ia.—The contract for paving several streets with brick was awarded, March 23, to Kenety & McCann of Dubuque for $18,000.

Portland, Me.—A contract for 7,000 square yards of granite paving blocks has been awarded to the Maine and New Hampshire granite company at $1.12 per square yard.

Cleveland, O.—The contract for paving Pearl, Platt and Bridge-sts. with Medina stone, was awarded to the Clafien paving and contracting company of this city. The work comprises about 20,000 square yards.

Erie, Pa.—Special.—The contract has been awarded to the Shale brick exchange, Canton, O., for 3,600 metropolitan blocks and 18,500 Canton red granite blocks.

Cleveland, O.—Special.—The Shale brick exchange company, Canton, O., was awarded the contract March 25 for 14,000 square yards of 5x8¾x3¾ special metropolitan block.

Des Moines, Ia.—The bids received March 5 for paving and curbing Nineteenth and Twentieth-sts., were considered too high. The bids were $1.70, while other recent contracts were awarded at $1.30.

Buffalo, N. Y.—Contracts were awarded to Michael Newell, ex-police commissioner, March 12, as follows: Trinidad asphalt, Red Jacket-st., $4,890; Norman-ave., $6,044; Baxter-st., $9,533; Alexander-place, $2,117.

Fall River, Mass.—The contract for furnishing 200,000 paving blocks to this city was awarded, March 4, to Henry Gardner of Millstone, Conn., at $49 per thousand; for 15,000 feet of curbing, J. B. Wilmot, at 62 cents per foot.

Buffalo, N. Y.—The contract for paving Main-st., from Niagara-st. to the New York Central tracks, was awarded to the Barber asphalt paving company March 21. The rest of Main-st. and Ontario-ave. was referred to the common council.

Crown Point, Ind.—John W. Call, Elwood, Ind., was awarded the contract for constructing eleven and one-fourth miles of country roads at $36,990, bids for which were received in this city Feb. 26. There were twenty bidders on this contract.

Kansas City, Mo.—Contracts for brick paving on five-inch concrete were awarded Feb. 25 as follows: F. P. McCormick, 1,822 square yards, $1.62, and 1,620 square yards, $1.53; Walter Williams, 3,452 square yards, $1.50½; G. E. Faris, 2,256 square yards, $1.27, on old concrete.

St. Louis, Mo.—Vitrified brick will be used to a great extent this year. Contracts were awarded March 20 as follows: Bell-ave., Hill-O'Meara construction company, $16,888.60; Cook-ave., St. Louis stonemasons' quarry and building association, $9,381.25; Maryland-ave., $23,116, and McPherson-ave., $8,386.50, E. C. Morrison; Euclid-ave., Henry Buckert, $16,650.23; Morgan-st., E. C. Morrison, $14.736.35; Page-boulevard, St. Louis stonemasons' quarry and building association, $7,912.90; Euclid-ave., E. C. Morrison, $16,912.90; Page-boulevard, St. Louis stonemasons' quarry and building association, $17,045; Pendleton-ave., St. Louis stonemasons' quarry and building association, $11,442.40; Taylor-ave., E. C. Morrison, $22,125.94. For constructing vitrified paving brick crosswalks, St. Louis quarry and construction company, $255. Total cost of contract, $221,518.06. The contract for improving Dilmar-boulevard, between King's highway and Union-boulevard, with Telford, was awarded to August & John C. Heman for $31,696, and between Union-boulevard and Clara-ave.

to the Hill-O'Meara construction company for $25,410.70.

Marietta, O.—(Special.)—E. Frank Gates, city engineer, says that 11,502 square yards of brick paving will be laid this spring. John Wilding is the contractor.

Williamsport, Pa.—The contract for repaving E. Third-st., from Penn-st. to the Philadelphia & Erie railroad, was awarded to D. P. Guise at his bid on his own brick, at $1.47 on a ten-year guarantee.

Buffalo, N. Y.—For repairing asphalt streets torn up in laying water mains, the Barber asphalt paving company, the German rock asphalt company and the Buffalo paving company, each bid $2.69, and each will get the contract for the streets on which its own pavement is laid.

Corry, Pa.—Bids were received for brick paving on concrete base and curbing as follows: Thomas McGuegum, Meadville, Pa., $16,092.76; Gradner & Bennett, Jamestown, N. Y., $15,133.22; James McCloud & Co., Columbus, O., $14,559.18; E. M. Ayres, Zanesville, O., $14,657.98; Jamestown construction company, $14,583.58.

Cambridge, Mass.—Bids were received March 15 for furnishing this city with 450,000 No. L granite paving blocks, 3½ to 4x7 to 8x7½ to 8 inches, as follows: Charles McMahon, East Cambridge, $39.87½ per 1,000 delivered during May and June; S. & R. J. Lombard, Charleston, Mass., $42 per 1,000 blocks.

Norwich, Conn.—The contract for paving W. Town-st. with macadam was awarded to Alden B. Nickerson of this city, as follows: Native stone, 57 cents per square yard; native stone with trap screenings, 61 cents per square yard; upper course with screenings, 83 and 88 cents; with cobble gutters, 40 cents.

Kenosha, Wis.—The contract was awarded March 16 to J. O. Jones of Racine for one course of brick paving on six-inch concrete and 10,000 feet of curbing at $1.25½ per square yard. Galesburg repressed brick will be used. The Talbot paving company bid $1.35 on Galesburg repressed brick and James Cape & Son $1.17½ on Clinton repressed brick.

Peoria, Ill.—(Special.)—A. D. Thompson, city engineer, says that bids were received March 24 for furnishing, setting and hauling curbing for the season of 1896. For furnishing 16,000 lineal feet of 5x20-inch, 3,000 feet 6x22-inch, 1,000 feet 5x24-inch, 3,000 feet 6x36-inch curbing and 600 lineal feet of 5x22-inch, 100 feet 5x22-inch, 100 feet 6x22-inch and 100 feet 6x36-inch corners. The bids ranged from 30 cents to 82 cents per lineal foot for curbing and from 47 cents to $1.20 per lineal foot for corners. The bids aggregated as follows: Cleveland stone company, Ohio sandstone, $8,656; Malone stone company, Ohio sandstone, $9,327.50; Peoria steam marble works, Ohio sandstone, $9,526.50; Oolitic limestone, $11,326; Charles Levings, Ohio sandstone, $13,167. For setting the curbing the bids ranged from 6¼ cents on sand to 5½ cents without sand to 15 cents on sand and 11 cents without sand, the bids aggregating as follows: Robert Walsh, $1,195; August Hoeppner, $1,200; Talbot paving company, $1,200; Bushown & Shwago, $1,330; Frank Hoeppner, $1,610; Fred Seifert, $2,240. For hauling curbing: A. W. Moffatt, $1,687.50; Peoria cartage company, $1,875; Thede Bros., $2,112.50; Charles Hamann, $2,300.

Columbus, O.—McCloud & Geigele secured the contract, March 9, for paving Spruce-st., between Park and Dennison-aves., and Cherry-st., between Cherry and Twenty-second, with Trimble block, at $1.05 per square yard. N. B. Abbott was awarded the contract for paving Oak-st., from Miller-ave. west to Fairwood-ave., at 58 cents per foot.

Erie, Pa.—The contract for paving Myrtle-st., between Fourth and Fifth, and between Fifth and Twelfth, with asphalt, was awarded to Mayer Bros., of this city, at $2.59 per square yard, $40 each for catch basins and $60 each for manholes. The Standard asphalt company of New York bid $2.69 per square yard, and the Metropolitan asphalt paving company bid $2.72 per square yard.

Indianapolis, Ind.—C. M. Kirkpatrick secured contract, March 18, for paving Mobile-st. with brick, from Senate to Capitol-ave., at $2.15 per lineal foot on each side; paving with brick the first alley south of Georgia-st., $1.55 per lineal foot; first alley west of Illinois-st., $1.20 per lineal foot. The contract for paving the first alley east of Senate-ave. was awarded to the Capitol paving and construction company at $1.44 per lineal foot on each side.

Philadelphia, Pa.—Contracts have been awarded for granite block paving at prices ranging from $3.10 to $4.15 per square yard. The Mack paving company was awarded the contract for paving twelve blocks, Thomas Cunningham five blocks, M. McManus four blocks and D. P. McMichael two blocks. This paving will be paid for out of the $500,000 appropriation made last year. The asphalt and other contracts to come out of this fund have not been awarded yet.

Saginaw, Mich.—(Special.)—R. F. Johnson, city clerk, says that the contract for paving Genessee-ave., from Tilden-st. to Jefferson-ave., with asphalt, was awarded to the Barber asphalt paving company at the following prices: Asphalt paving, $2.34 per square yard; excavation, 5 cents per cubic yard; laying tile drain, 25 cents per rod; new Medina curb-stone, 59 cents per foot; dressing and setting old curb-stone, 23 cents; 6-inch tile basins, $2 each. All of the paving contracts for the season are now let, with the exception of one street, which will probably be of rectangular or square cedar blocks upon a concrete foundation.

CONTRACTS TO BE LET.

Des Moines, Ia.—The bids for paving Sixth-st. with brick were rejected. New bids will be asked.

Kansas City, Mo.—Sealed proposals will be received until April 13 for macadamizing two roads. Check, $200. F. J. O'Flaherty, county surveyor.

Albany, N. Y.—Sealed proposals will be received until April 6 for paving as follows: Trinidad asphalt over present granite pavement, Maiden lane, from Broadway to N. Pearl; vitrified brick, Elberon place, from Lake-ave. to Quail-st. Thomas J. Lanahan, clerk.

Cincinnati, O.—Sealed proposals will be received until April 8 for paving Blackburn alley with brick, from Liberty to Washington-st.

Chicago, Ill.—Bids will be received until April 4 for furnishing 1,500 lineal feet of granite curbing for Washington park. E. G. Shumway, secretary.

Ft. Wayne, Ind.—Sealed proposals will be received until April 10 for paving with vitrified brick and constructing sidewalks. Check, $25. Thomas D. de Vilbiss.

Little Rock, Ark.—Sealed bids will be received until April 4 for repairing the Baring Cross turnpike. Certified check, $100. W. A. Compton, county judge.

Terre Haute, Ind.—Sealed proposals will be received until April 21 for paving Seventeenth-st. with broken stone, from Poplar to Hulman, and paving the sidewalks with screened gravel.

Zanesville, O.—Sealed proposals will be received until April 17 for paving Haveline-ave., from Greenwood-ave. to E. Spring-st., with vitrified brick. Charles N. Bainter, city clerk.

Helena, Mont.—Sealed proposals will be received until April 18 for constructing about 1,725 lineal feet of stone and gravel road on the Ft. Harrison military reservation. George S. Hoyt, assistant Q. M., U. S. A.

Chicago, Ill.—Sealed proposals will be received until April 8 for paving Milwaukee-ave. viaduct with round cedar blocks; round cedar, 1,400 square yards; rectangular oak, 200 square yards. Check, $200. W. D. Kent.

St. Louis, Mo.—Contracts for street improvements have been awarded by Commissioner Milner as follows: To the Fruin-Bambrick construction company, paving with vitrified brick alleys in city blocks No. 3,915, $5,668.50; No. 3,756, $1,734.66; No. 4,583, $3,065.76; No. 5,041, $1,781. To the Skrainka construction company, paving with granite blocks alleys in blocks No. 4, $1,168.40; No. 14, $1,269; No. 66, $587.50; No. 84, $1,057.50; No. 133, $705; No. 134, $1,034; No. 167, $1,245.50. To H. Ruecking & Co., paving with vitrified brick alley in block No. 2,118, $1,433.22.

Saginaw, Mich.—The contract was awarded, March 6, to John Schultz, for paving Tuscola-st. with brick from Tilden to Warren, at $1.16 per square yard, and Thompson-st. with sapless cedar blocks at $1.03½ per square yard. W. H. Wallace secured a contract, March 13, for paving Weadock-ave., from Lapeer to Genesee, with brick, at $1.09 per square yard. Bids were received the same day for furnishing common cement for the season, and the contract was awarded to Ewen & Co., Milwaukee cement, at 63 cents per barrel. Bids were received for Portland cement also, but owing to some disunderstanding on the part of the bidders the bids were referred to the committee on streets.

To August & John C. Heman, paving with vitrified brick alleys in city blocks No. 4,473, 4,474, 4,475 and 4,476, $3,681.10. To St. Louis Quarry and Construction company, reconstructing with granitoid pavement southern part of north and south alley in city block No. 100, $4.64; improving Kennedy avenue, between Taylor and Marcus avenues, $11,610.05.

West Haven, Conn.—Sealed proposals will be received until April 4 for constructing a macadam pavement on Main-st. Walter A. Main, selectman.

Richmond, Ind.—Bids are invited until April 17 for 5,100 feet of stone curbing and 2,000 feet of grading. H. L. Weber, city engineer.

Minneapolis, Minn.—At a meeting of the City Council March 13, contracts were awarded for paving, bids for which were received Feb. 21, as follows: All streets without street car tracks, Assyrian asphalt company, using Utah lime rock asphalt, at $2.40 per square yard; all streets with street car tracks, Warren-Scharf asphalt paving company, at $2.45 per square yard. The Bermudez Asphalt company's bid was $2.51 on all streets. In accordance with section 19, of the specifications, it was supposed that the California company would bid, but it did not claiming that the notice was too short. The resolution awarding the contract has been vetoed by Mayor Pratt. The contract awarding Seventh street to Trainor Bros. was annulled. The contract was awarded on condition that two kinds of brick were used, as a test. The bidders refused to accept this condition, and the bids were rejected.

Louisville, Ky.—Contracts were awarded March 2 for reconstructing portions of nine streets. The bids were received February 29. The Barber Asphalt Paving company was awarded contracts for resurfacing with asphalt two streets, at $19.80 and $19.90 per square for asphalt and 70 cents per lineal foot for flag gutters. J. R. Gleason was awarded contract for paving five streets, two with granite blocks and three for paving with brick, as follows: Abutment stones 9 feet long, 50 cents to 70 cents; brick paving, $15 and $15.50 per square of 100 for the Bannon brick, 1,097 squares, and granite block paving with bituminous joints, $24.50 and $25 per square, or $27 and $27.50 for gravel joints, 245 squares. L. R. Figg was awarded a contract for paving one street with brick, 66 squares, at $14.75 for Bannon brick and $15 for Mack brick, 525 lineal feet flags gutters, 55 cents, and 1,050 lineal feet binders, 51 cents.

Indianapolis, Ind.—Bids were received March 25 for asphaltic paving and contracts were awarded as follows: Palmer street, from Meridian to Madison avenue, Indiana Bermudez Asphalt company, $4.07 per lineal foot on each side; New York, from West to East, Western Paving and Supply company, $6.20 per lineal foot on each side; East street, from Ohio to St. Clair, Warren-Scharf Asphalt Paving company, $6.40 an each side; East street, from Washington to Ohio, Warren-Scharf Asphalt Paving company, $6.05 on each side. Parkhurst curb will be used on both sections of East street. The Fruin-Bambrick Construction company of St. Louis presented bids on the work as follows: Palmer street, $3.74, any curb except granite; $4.24 if granite; New York street, $5.85, $6.35 with granite curb; East street, from Washington to Ohio, $5.60, $6.10 with granite curb; East-st., from Ohio to St. Clair, $5.99, $6.49 with granite curb. After consultation with the city attorney the board of public works

decided to award the contracts to the old companies on the ground that the Fruin-Bambrick company could not conform to section 15 of the specification, which provides against granting a contract to any company that cannot prove that it has constructed an asphalt pavement, which, after having been subjected to three years' heavy traffic and submitted to temperature varying from 20 to 110 degrees, shall be equal to the best asphalt pavement in the city. President Downing of the board of public works expressed a wish that the Fruin-Bambrick company will bid again on a number of large contracts that will be let this year, and said that the specifications would be changed so as to admit it hereafter.

Hartford, Conn.—(Special.)—C. H. Bunce, city surveyor, says the contract for paving Main-st., between Arch and Windsor-sts., for which bids were received March 4, was awarded to the Southern New England paving company of this city at $2.49 per square yard. Trinidad lake asphalt will be laid on a 6-inch concrete base with five years' guarantee. Other bids received were: Henry & McGivney, Jersey City, Mexican asphalt, $2.53; Boston asphalt company, Boston, Sicilian asphalt, $2.69; T. D. Bradford, Brooklyn, California asphalt, $2.67; Hartford paving and construction company, Hartford, Alcatraz asphalt, $2.42; E. W. Clark & Son, Hartford, Trinidad lake asphalt, $2.60; Barber asphalt paving company, New York City, Trinidad lake, $2.76; Warren-Scharf asphalt paving company, New York City, Trinidad lake, $2.70.

CONTRACTS TO BE LET.

Duluth, Minn.—Contracts will be let about June 1 by the Board of County Commissioners for building county roads.

Kansas City, Mo.—Sealed bids are invited until April 3 for macadamizing and grading several roads. Check $200 cash. E. J. O'Flaherty, County Surveyor.

Ida Grove, Ia.—Bids will be received April 6, by the trustees of Silver Creek township, Ira county, for the working of highways in that township for the year 1896. G. R. Pultz, Township Clerk.

Kansas City, Mo.—Sealed proposals will be received until April 6 for paving Eighteenth-st., from Woodland-ave. to Olive-st.; Whittier-place, from Oak to Locust-st. Check, $200. H. H. Filley, City Engineer.

Irvington, Ind.—Sealed proposals will be received until April 6 for grading and paving with cement the south walk of Washington-st., from Ritter to Coleman-ave., and the north walk of Washington-st., from Central to Blount-ave.

Kankakee, Ill.—Bids will be received until April 13 for grading, curbing, paving and macadamizing and constructing stone sewers and intakes. The approximate quantities of the work are as follows: Twelve and fifteen-in. vitrified pipe, 6,000 lin. ft.; 600 ft. 9-in. laterals; 70 castiron curb intakes; 7,000 lin. ft. cement curb; 9,000 lin. ft. stone curb; 30,000 sq. yds. brick pavement; 15,000 sq. yds. macadam pavement. Proposals will be received for the whole or part of the work. Bond, $500. W. K. Woodruff, City Engineer.

Bloomfield, Ind.—The contracts will be let April 2 for a system of gravel roads connecting Switz City, Lyons, Marco and Newburn with this city. The system will embrace 85 miles of gravel roads. Stephen Anderson, William Exline, Lafayette Jessup, Commissioners.

Muncie, Ind.—Sealed proposals will be received until April 6 for grading the sidewalks on the east side of Walnut-st., from Eighth to Ninth., and paving with good Portland cement on a good Portland cement, concrete foundation. Bond, $50. F. A. Elrod, City Clerk.

Freeport, Ill.—Sealed proposals will be received until April 4 for grading, curbing, paving with brick and macadamizing certain portions of Stephenson-st., in West Freeport. Grading 4,800 cu. yds.; curbing 4,865 lin. ft.; brick 9,720 sq. yds.; macadamizing 1,355 sq. yds. Check, $500. William I. Brady, President Board of Trustees.

Highland Park, Ill.—Sealed proposals will be received until April 7 for paving and curbing as follows: Brick, St. John's-ave., 2,460 sq. yds.; macadam, Central and St. John's, 18,900 sq. yds.; cedar blocks, Central-ave., 5,260 sq. yds.; brick guttering, 8,800 lin. ft.; stone curbing, 1,900 lin. ft.; plank curbing, 1,600 lin. ft.; drains, 13,500 lin. ft.; grading, 20,000 cu. yds. Check, $500. John Finney, City Clerk.

Athens, O.—Sealed proposals will be received until April 20 for grading, excavating, foundation, limestone, graveling, etc., about 151,208 feet of roads. The roads will be divided into sections, and bids will be received for any section or sections. A. J. Frames, County Auditor.

Pleasant Ridge, O.—Sealed proposals will be received until April 6 for grading and macadamizing Williams-st., from Ridge-ave. to Locust-st., and constructing concrete, combined curb and gutter, and reconstructing approaches of lateral streets. Guarantee, $1,000. Robert T. Hutton, Clerk.

SEWERS.

CONTEMPLATED WORK.

Bedford, Ind.—The proposed construction of a sewerage system is being given considerable attention by the council.

Taylor, Tex.—A sewerage system is contemplated.

Kingston, N. Y.—The Second and Ninth ward sewers will be enlarged.

Toledo, O.—A cylindrical brick sewer will be constructed in Detroit-ave.

Highland Park, Mich.—Plans have been ordered prepared for additional sewers.

Woodville, N. H.—A sewerage system will probably be constructed this spring.

Fredricton, N. B.—The construction of a sewerage system is under contemplation.

Tewksbury, Mass.—A report has been submitted on the proposed sewerage system.

Joliet, Ill.—A sewerage system in the Spring creek valley district is contemplated.

Lexington, Mass.—The sewerage committee reported in favor of the filtration system.

Oneida, N. Y.—An appropriation of $15,000 will be asked for the purpose of constructing a sewerage system in this village.

Lancaster, O.—Plans have been prepared by John N. Wolfe, city engineer, for sewers.

Binghampton, N. Y.—Sewers will be constructed in Doubleday, Eldridge and Emmett-sts.

Wilmington, Del.—A sewer will be constructed on Ninth-st., between Monroe and Tatnall.

Mobile, Ala.—The sewerage committee has reported in favor of the Brownell plan of sewerage.

Chester, Pa.—A number of petitions have been presented to council for sewers in the First ward.

Paxton, Ill.—Plans and estimates have been prepared for a sewerage system; estimated cost, $20,000.

Oakland, Cal.—Plans have been submitted for a storm sewer from Telegraph-ave. into Lake Merritt.

Columbus, O.—An ordinance has been recommended to issue $23,000 in bonds for sewerage purposes.

Fulton, N. Y.—The question of constructing a sewerage system will be voted upon again during April.

Watertown, Mass.—The construction of a sewerage system in Norwood park and at the Sand Banks is proposed.

Wallace, Wash.—The question of issuing $25,000 in bonds for a sewerage system will be voted on April 7.

Peoria, Ill.—The construction of a sewerage system in the lower end of the city is being considered by council.

Ocean Grove, N. Y.—Parker N. Black has been engaged to prepare a map of the proposed area to be covered by sewers.

Westerly, R. I.—Plans and estimates have been prepared for a sewerage system by J. Herbert Shedd of Providence.

Jersey City, N. J.—The street and water commissioners have approved applications for 27 sewers in various parts of the city.

Waukegan, Ill.—Sewer district No. 1, bounded by State-st., North-ave., Gillett-ave. and Glen Flora-ave., will be extended.

Sherman, Tex.—(Special).—J. H. Wharton, city secretary, says that the sewerage surveys, including map, will be made by C. W. Olcutt for $375. He also says that no road machinery is needed.

St. Louis, Mo.—A sanitary sewer is contemplated in the neighborhood bounded by Loughborough, Iowa, Ninth and Pennsylvania-sts.

Cincinnati, O.—A resolution has been ordered prepared in relation to the proposed trunk sewer, known as the Bates Run extension.

Mexico, Mex.—Plans and specifications are being prepared for the contemplated sewerage system by S. M. Gray, C. E., of Providence, R. I.

Adrian, Mich.—A report on the construction of a general sewerage system has been submitted by H. E. Riggs, C. E., of Toledo, O.

Hamilton, O.—Resolutions have been passed declaring it necessary to build sewers in storm sewer districts Nos. 7 and 8. M. O. Burns, City Clerk.

Kewanee, Ill.—Mr. Walter C. Parmley, Peoria, Ill., has been engaged to report on methods of sewage disposal and to design works for treating the sewage of this village.

Galveston, Tex.—(Special.).—G. Bowden Little advises us that nothing in the line of municipal improvements is contemplated for the immediate future.

Philipsburg, Mont.—(Special). — Julius Hansen, city clerk, says that a sewer may be built, but nothing definite has been done up to the present time.

New Haven, Conn.—An appropriation of $100,000 for sewers, $250,000 for paving and $50,000 for a new draw bridge has been recommended by A. C. Hendrick, Mayor.

Sacramento, Cal.—The board of trustees and the chamber of commerce have agreed on the location of a pumping plant, which will be on the river front at S.-st.

Columbus, O.—A committee has been appointed to confer with George Danenhouer, C. E., of Cincinnati, relating to the proposed improvement of the sewage disposal plant.

Tucson, Ariz.—A resolution was passed recently to urge Delegate Murphy to hurry the passage of the bill now before congress authorizing the issue of bonds for the construction of sewerage and water works systems.

Alton, Ill.—A plan is proposed to change the drainage system. The sewage is now carried into the Piasa sewer, but it is proposed to build another trunk sewer at Walnut-st., and to extend the Front-st. sewer from Henry to Walnut-sts.

Mendota, Ill.—Mr. Charles P. Chase of the Iowa Engineering company, Clinton, Ia., has made a revised sewer plan, which has been accepted. The Iowa Engineering company will superintend the construction of the system.

Quincy, Ill.—City Engineer Chatten has recommended an increase of the size of the trunk sewer for the North End. Engineer Phillips's plans were made for a population of 76,000 in the district, and he says that if there is a probability of a larger population in the territory the proposed change will be advisable. No definite action on the matter has yet been taken by the council. The change will increase the cost of the sewer about one-fifth.

Altoona, Pa.—(Special.)—Harvey Linton, city engineer, says that this city has recently purchased a tract of 95 acres of ground, located more than three miles south of the Fourth district sewer outfall at the city line. Of this area 70 acres are suitable for sewage filtration, and there will be constructed, after April 1, thirty-six filter beds, making probably the largest sewage disposal plant of this character in the United States. Messrs. Noyes & Hazen of Boston are consulting engineers.

San Antonio, Tex.—Work on the sewerage system is at a standstill owing to questions at issue between the contractors and city, which will have to be adjudicated in the courts. The main question at issue is the proper classification of material encountered in making excavations, which the contractors claim should be classified as hard rock, while City Engineer Pancoast claims that under the specifications it can only be classified as dirt. The difference in the price of excavating hard rock and dirt is so great that the question has become a vital one. Wilding, Marshall, Backus & Hines are the contractors.

Galveston, Tex.—In the report of the preliminary committee on sewerage, Drs. Cline and Trueheart and City Electrician David Hall, an appropriation of $1,500 was recommended to cover the cost of securing Col. George E. Waring, jr., as consulting engineer.

Sidney, O.—A resolution was passed March 23 authorizing the mayor and clerk to sign an agreement with the state board of health to comply with its order respecting the proposed plan for a sewerage system. The plans were prepared by Mr. Coulson and have been accepted.

Salem, Ore.—(Special).—W. B. Barr, engineer and superintendent, says that no contract has yet been awarded for the construction of the state sewer, and will not be for probably a month, if at all. There is a probability that the work will be done by day's labor.

The question of constructing sewers and sewerage systems will be voted on as follows: Oneida, N. Y., two trunk sewers, April 7; Winton-place, O., system, April; Kalamazoo, Mich., April 6; Atchison, Kas., April 7; Geneva, N. Y., Mansfield, O., sewage disposal system, April 1.

CONTRACTS TO BE LET.

Beatrice, Neb.—Bids will be received some time during April for storm sewers. Willis Ball, City Engineer.

Salt Lake City, Utah.—Bids will be asked at once for the construction of a main sewer in Fifth South-st.

Richmond, Ind.—Bids are invited until April 17 for constructing 3,800 ft. of pipe sewers. H. L. Weber, City Engineer.

Hartford, Conn.—Sealed proposals will be received until April 11 for the intercepting sewer. Certified check, $200. C. H. Bunce, City Surveyor.

New York, N. Y.—Bids are asked until April 2 for constructing and altering sewers in five streets.

Richmond, Ind.—Sealed proposals will be received until April 17 for constructing a pipe sewer. Joseph H. Winder, City Clerk.

Keokuk, Ia.—Sealed proposals will be received until April 13 for constructing sewers. Certified check, $100. W. H. Jones, City Engineer.

Brooklyn, N. Y.—Sealed proposals will be received until April 2 for constructing sewers in several streets. Theodore B. Willis, Commissioner City Works.

Ft. Wayne, Ind.—Sealed proposals will be received until April 10 for constructing a twelve-inch vitrified clay pipe sewer. Check, $25. Thomas D. de Vilbiss.

Decatur, Ill.—Sealed bids will be received until April 6 for the construction of the Fourth ward sewer. Bond or certified check, $1,000. F. L. Hays, City Clerk.

Toledo, O.—Sealed proposals will be received until April 20 for constructing a cylindrical brick sewer in Fassett-st. Deposit, $200. Lem P. Harris, City Clerk.

Altoona, Pa.—(Special.)—The committee in charge of sewage disposal, Fourth district, will receive till 6 p. m., April 3, proposals for furnishing and laying 30,000 feet, more or less, of 3, 4, 5 and 6-inch drain tile, and 8, 10 and 12-inch sewer pipe, together with iron pipe for outlets. Proposals must be accompanied with a certified check for $250. W. L. Shellenberger is chairman of the committee.

Kankakee, Ill.—Bids are invited until April 13 for constructing 6,600 ft. of 15 to 9-in. pipe sewers. John H. Brayton, Mayor; W. K. Woodruff, City Engineer.

Mendota, Ill.—(Special).—The contract for 9 miles of 6 to 18-inch sewers will be let about May 1. The notices are not yet out. Iowa Engineering Company, Clinton, Ia.

Hamilton, O.—Sealed proposals will be received until April 17 for building one and one-half miles of sewers in districts Nos. 7 and 8. Certified check, 10 per cent. M. O. Burns, City Clerk.

Salt Lake City, Utah—Sealed proposals will be received until April 4 for a pipe sewer in Fifth South-st., between Second East and Tenth East-sts. A. F. Doremus, Chairman B. P. W.

St. Paul, Minn.—Sealed bids will be received until April 2 for a sewer in Frank-st., from Reancy to a point 100 feet south of Beech-st. R. L. Gorman, President B. P. W.

Buffalo, N. Y.—Bids are asked until April 2 for constructing a 36-inch brick sewer in Bryant-st., and 20 and 12-inch pipe sewers in two streets. R. G. Parsons, Secretary D. P. W.

Eufaula, Ala.—Sealed proposals will be received until April 2 for constructing 7½ miles of 6 to 18-inch pipe sewers, and for furnishing sewer pipe. Separate bids. P. B. McKenzie, Mayor; G. A. Roberts, City Clerk.

Waukegan, Ill.—Sealed bids will be received until April 20 for constructing 5,000 feet of pipe sewers and 17 manholes, 28 catch basins, more or less, on State-st. and Gillette-ave. Certified check, $300. R. B. Connolly, City Clerk.

Corning, N Y.—Sealed proposals will be received until April 18 for the construction of a system of protection from the floods of the Chemung river, consisting of the following: Earthen dykes, containing about 330,000 cu. yds.; two highway bridge spans, two piers and two abutments; two brick conduits and one conduit of vitrified pipe; several short lines of castiron pipe, with valves and boxes; about 400 cu. yds. of paving, and about 1,600 cu. yds. of retaining wall masonry. Frank D. Kingsbury, Chairman Board River Commissioners.

Keokuk, Ia.—Bids will be received until April 3 for constructing sewers, requiring, approximately, the following: Excavation, 800 cu. yds; brick sewer, section A, 890 lin. ft.; section B, 240 lin. ft.; section C, 37 lin. ft.; manholes, 20 lin ft.; 18-in. pipe sewer, 100 lin. ft.; 12-in. pipe sewer, 200 lin ft.; 6-in. side inlets, 130 inlets; gravel, 200 cu. yds.; sheet piling, 6,000 ft. Second: Excavation, 500 cu. yds.; brick sewer, 650 lin. ft.; 12-in. pipe sewer, 200 lin. ft.; 6-in. side inlets, 65 inlets; gravel, 200 cu. yds.; sheet piling, 5,000 ft. Check, $100. W. H. Jones, City Engineer.

CONTRACTS AWARDED.

Jersey City, N. J.—Edward O'Neil was awarded the contract for a sewer in Clinton-ave. for $518.31.

Cincinnati, O.—Van Sandt & Meeds secured the contract for building a sewer in Dreman-ave. for $340.

Richmond, Ind.—William Rehling, city, was awarded the contract, Feb. 28, for constructing pipe sewers for $7,300.

Bedford, Mass.—Seymour & Banker of Gloversville, N. Y. secured the contract March 16, for constructing 1¼ mi. of 15 and 20-in. pipe sewers for $14,740.

Duluth, Minn.—The Menominee Pressed Brick company, Menominee, Mich., was awarded the contract for 76,000 sewer brick for lining the new intake well, at $10.20 per M.

Albany, N. Y.—The contract for a drain in Jefferson-st. and Madison-place was awarded March 16 to Joseph H. Clement of Schenectady for $5,143.03.

Middlesborough, Ky.—The contract for constructing a sewer in Twentieth-st., from Cumberland-ave. to the canal, was awarded to Charles Sandford March 16 for $340.

Washington, Ind.—Braden & Crossen secured the contract for building a 24-in. sewer, 270 ft. long, on W. Eleventh-st., from Main to the B. & O. railroad, for $223.10.

Covington, Ky.—The contract for constructing a sewer and appurtenances in Sixth-st., between Central-ave. and Columbia-st., was awarded to J. J. Hastings for $410.41.

Kansas City, Mo.—The Robert J. Boyd Paving and Construction company was awarded the contract for constructing the O. K. creek interceptor for $16,920. The bids were received March 5.

New Bedford, Mass.—Contracts have been awarded as follows: Hoffman brand cement, Corson coal company, 95 cents per barrel; Barrington and Taunton brick, S. S. Paine & Bro.; sewer pipe, Charles S. Paisler.

Evansville, Ind.—The contract for constructing two sewers was awarded to Sherwood & Co. at 45 cents per ft.; $19 for manholes, and $1.25 for Y's for one sewer, and 50 cents per ft., $20 for manholes and $1.50 for Y's for the other one.

Arlington, Mass.—Bids were opened March 24 for constructing two sections of sewers. On one section the bid of Lennox & O'Brien of North Cambridge, $32,175, was the lowest. On section 2, John Sheehan of Lynn, presented the lowest bid, $23,385.

Rochester, N. Y.—The contract for constructing the Central-ave. outlet sewer tunnel, bids for which were opened March 7, has been awarded to Lauer & Hagaman for $2,799.80. The other bids were: Brayer & Albaugh, $2,854; Whitmroe, Rauber & Vicinius, $3,191.

Rome, N. Y.—The contract for a sewerage system was awarded to George S. Miller & Co. of Ottawa, Ill., for $148,595.04.

Providence, R. I.—The New England steam brick company, Barrington, was awarded the contract for 3,000,000 bricks for sewerage improvement.

Rock Falls, Ill.—The contract was awarded March 16 to H. D. Hallet of Aurora for the construction of the Bridge and Elm-sts. sewer system for $2,974.90. The other bids were: Thomas Toles, Rockford, Ill., $3,154.98; Berry & Welch, Iowa City, Ia., $3,450.13; A. E. Rutledge, Rockford, $3,244.96; Will Horrabin, Iowa City, $3,552.01.

Nyack, N. Y.—The contract for building the sewerage system was awarded to the Manhattan Supply company of New York City for $40,000.

North Tarrytown, N. Y.—The sewer commission has opened nineteen bids for constructing the new sewer system, varying in price from $11,000 to $19,000. The contract has not yet been awarded. A diversity of opinion between the commission and the members of the Good Government club may delay the awarding of the contract.

Indianapolis, Ind.—Sewer contracts have been awarded during March as follows: Main sewer in Capitol-ave., from Fall creek to Kenwood addition, 5,345 ft., Indiana Construction company, $3.10 per lin. ft.; local sewer in North and Wood-sts., 935 ft., Daniel Foley, 90 cents; local sewer in New York-st., from Senate-ave. to a point 270 ft. west, Indiana Construction company, 95 cents; local sewer in Vermont-st., near East, Gansberg & Roney, 97 cents.

Monterey, Mexico. — Messrs. Aaron French of Pittsburg, J. A. Robertson of Monterey, and Samuel M. Gray of Providence, R. I., are interested in an American syndicate which has been granted a concession by George Reyes of the state of Nuevo Leon, Mexico, for the construction of a sewerage and water works system in this city. The concession is one of the most liberal ever granted, being perpetual and exempting the property from taxation for forty years.

Westfield, N. J.—(Special).—F. A. Dunham, C. E., Plainfield, N. J., and engineer in charge for the construction of sewage disposal bids and house connections and cellar drains in Westfield township, says that bids were received March 14 for house connections and cellar drains as follows: Quinlan & Clark, South Amboy, N. J., $4,760; Faughnan & Wade, Elizabeth, N. J., $6,110; Headley & Christie, Newark, N. J., $6,290; P. T. Plunkett, Jersey City, N. J., $6,615; J. H. McKnight, Pittsburg, Pa., $7,055; F. H. Cordtmeyer, Long Island City, N. Y., $9,340; Patrick McShane, Paterson, N. J., $11,275. Sewage disposal beds: Smith & Conover, Freehold, N. J., $6,664.85; John Marsden, Utica, N. Y., $7,443.25; R. H. Bethel, 400 Temple Court, New York City, $8,033.05; Mitchell & Neff, Newark, N. J., $8,460.75; J. H. McKnight, South Diamond-st., Pittsburg, $8,744.50; Faughnan & Wade, Elizabeth, N. J., $10,205.40.

Scranton, Pa.—Bids were received March 5 for constructing a lateral sewer in Munsey-ave., between Green Ridge and Marion-sts., as follows: John T. Fitzpatrick, city, $1.69 per lin. ft.; V. H. O'Hara, city, $1.69; Peter T. Milligan, city, $1.68; B. M. Fox, city, $1.90; Bolton G. Coon, Kingston, Pa., $1.57; Jennings & Grier, city, $1.67; Hart & Gibbons, Wilkesbarre, $1.94. The average depth of the sewer is 11½ feet, 3 manholes, 1 catchbasin, 12 and 10-in. pipe.

WATER-WORKS.

CONTEMPLATED WORK.

Conneautville, O.—This town has voted to put in water works.

Saranac, Mich.—The water works question has been favorably voted on.

Union Springs, Ala.—Bonds have been sold for the construction of water works.

Princeton, Mo.—This town has voted in favor of water works and electric lights.

Mt. Airy, N. C.—This town has voted to issue $25,000 in bonds for water works.

The water works question is being agitated at Cadiz, Ky., and Lancaster, N. Y.

Houston, Tex.—Plans are being prepared for a new reservoir by Chester B. Davis, Chicago.

Canton, O.—An issue of $50,000 on bonds has been recommended for water main extension.

Duncombe, Ill.—The question of a system of water works has been favorably voted upon.

Newark, N. J.—An appropriation of $60,000 more than was appropriated last year has been requested for extending and laying water mains.

Bellevue, Ia.—The question of issuing bonds for a new reservoir will be voted upon April 6.

Warren, Pa.—A water works system has been voted for and plans, bids, etc., will probably follow.

Hart, Mich.—The election, March 9, to bond this village for water works and electric lights carried.

Philadelphia, Pa.—The ordinance supporting the measure of filtration failed to pass in common council March 19.

Jamestown, N. Y.—(Special) O. B. Jones, acting clerk, says that no steps have been taken as yet toward a municipal water plant.

Boston, Mass.—The Metropolitan water commission has decided to spend $117,000 on Spot Pond as a basin for a water supply.

Osage, Ia.—The questions of granting a water works franchise or constructing a system are under consideration. W. E. Owen, City Clerk.

Spokane, Wash.—(Special.)—A ten million gallon reservoir will be constructed and three miles or more of water mains extension will be made this year.

Little Falls, N. Y.—A bill has been introduced in the assembly authorizing this city to issue bonds for $50,000 for the purpose of increasing the water supply.

The construction of water works systems is contemplated at the following places: New Hartford, Ia.; Cameron, Mo.; Galt, Mo.; Medway, Mass.; Ligonier, Pa.; Edgerton, Wis.; Hancock, Md.; East Lyme, Conn.; Greenville, S. C.; Franklin, Ky.; Vernon, N. Y.; Huron, O.

The water works question will be voted on at the following places: Chariton, Ia., Irvington, Ind., April 6; Oconamowoc, Wis., in April; Parkersburg, Ia., Idaho Falls, Idaho, May 12; Blanchester, O., April 13; Wellsville, O., April 6.

Oshkosh, Wis.—The Wisconsin Water Works association was organized Feb. 26 in this city. The decided tendency to municipal ownership of water works systems which has manifested itself in Wisconsin led the public to believe that it had not been without effect upon the private corporations, and that this association was formed for the purpose of taking precautionary steps against municipal ownership.

Woodburn, Ore.—The citizens have voted in favor of issuing $10,000 in bonds for a water works and electric light plant.

Providence, R. I.—The report of the committee on city engineer's department recommends sand filtration for the water supply.

CONTRACTS TO BE LET.

Walnut, Ia.—Bids will be received until April 15 for constructing water works. T. R. Beardsley, Mayor.

Cincinnati, O.—Bids are invited until April 20 for pipe, castings and other supplies. A. P. Butterfield, Clerk of B. A.

Geneva, Ill.—Bids will be received until April 15 for constructing a system of water works. D. M. Flynn, City Clerk.

Boston, Mass.—Bids are asked until April 23 for laying about 20,000 ft. of 48-inch pipe. F. P. Stearns, Chief Engineer.

Martin, Tenn.—This city is open for bids from parties who desire a franchise for a water works system. J. E. Kennedy, Mayor.

Clarksville, Tenn.—Sealed proposals are invited until April 10 for building a reservoir to hold 1,000,000 gallons of water. N. L. Carney, Mayor.

Hector, Minn.—Sealed bids will be received until April 15 for the construction of a system of water works. James Chapman, Village Recorder.

Eufaula, Ala.—Sealed proposals will be received until April 23 for constructing a system of water works. P. B. McKenzie, Mayor; G. A. Roberts, Clerk.

West Troy, N. Y.—Bids are invited until April 6 for laying about 7,000 ft. of 16-in. pipe. Alexander Potter, 137 Broadway, New York City, consulting engineer.

Nyack, N. Y.—Sealed proposals will be received until April 8 for furnishing and laying 10.41 miles of cast iron pipe, specials, etc. Certified check, $500. E. H. Cole, Clerk.

Sullivan, Ind.—Sealed proposals will be received until April 16 for the construction of a complete water works system. Certified check, 50 per cent. Fred Hoke, Clerk Town Board.

Clifton Springs, N. Y.—Sealed proposals will be received until April 9 for constructing a gravity system of water works. Certified check, 2 per cent. H. S. Allis, Secretary Board of Water Commissioners.

Lynchburg, O.—Sealed proposals will be received until April 9 for constructing a water works and electric light plant. E. F. Layman, 64 E. Third-st., Cincinnati, consulting engineer; Thomas Montgomery, Village Clerk.

BRIDGES.

La Salle, Ill.—A highway span over Big Vermillion run is contemplated.

Painesville, O.—The question of building a bridge will be voted on April 6.

Harrisburg, Pa.—A new bridge is contemplated over Rattling creek at Market street.

Lemont, Ill.—The highway commissioners have decided to build a new bridge across Long run.

Canton, S. D.—Bids are asked until April 8 for constructing pile bridges for the year 1896.

Spokane, Wash. (Special.)—Otto A. Weile, City Engineer, says that a bridge 300 feet long will be built.

Iowa City, Ia.—Sealed bids will be received April 10 for the county bridge work for 1896. T. L. Crowley.

Colorado Springs, Col.—Plans are being made for three new bridges which the city contemplate building.

Yankton, S. D.—The city council will probably grant a petition for a pontoon bridge across the Missouri river.

Mt. Carroll, Ill.—The question of building a bridge across the mill pond, at a cost of $5,000, is being agitated.

Westmoreland, Kas.—Bids are invited until April 13 for constructing an iron bridge. Frank Davis, County Clerk.

Pawnee Rock, Kas.—The County Commissioners have decided to build a bridge across the Arkansas river at this point.

Leavenworth, Kas.—Sealed proposals will be received until April 3 for building a bridge. J. W. Niehaus, County Clerk.

Mankato, Minn.—Bids will be received until April 21 for constructing a bridge. R. S. Hughes, Chairman, County Commissioner.

Freemansburg, Pa.—A bridge across the Lehigh river at this place is contemplated by the county commissioners. J. M. Porter, Engineer.

Rochester, N. Y.—A bridge, 400 feet long, is proposed over Deep Hollow at Glenwood Park. John Y. McClintock, City Engineer.

Youngstown, O.—A bill has been introduced giving the County Commissioners authority to build two overhead bridges across the river here.

Cleveland, O.—Plans are being prepared by Chief Engineer Rawson for the proposed bridge across Walnut river, from Harbor to Guage-sts.

Cottonwood Falls, Kas.—Proposals are invited until April 7 for building a double stone arch bridge. Deposit, $50. M. K. Harmon, County Clerk.

Corning, N. Y.—Bids are invited until April 18 for two highway bridge spans, two piers and two abutments. Frank D. Kingsbury, Chairman.

Sioux City, Ia.—(Special).—F. E. Cleaves, city clerk, says the contract was let March 9 for a bridge across Bacon Hollow creek for $1,735.

Whately, Mass.—The Wrought Iron bridge company at Canton, O., was awarded the contract for a three-plate girder span bridge for $1,087.

Fergus Falls, Minn.—The contract for a bridge across the Red river was awarded to the Wrought iron bridge company of Canton, O., for $1,793.

St. Louis, Mich.—The citizens will vote, April 7, on the question of bonding the city for $3,500 for a steel bridge over the Pine at the foot of Mill-st.

Latham, Ill.—Bids will be received until April 10 for building five bridges across the north branch Lake Fork channel. Certified check, $2,500. D. H. Sims, Commissioner.

Kansas City, Mo.—The contract will be let, April 14, for building one arch culvert on the Raytown road, south of Leeds. Check, $200. E. J. O'Flaherty, County Surveyor.

Hawkinsville, Ga.—Bids will be received until May 6 for placing iron or steel viaducts to the west side approaches to the river bridge. P. T. McGriff, Ordinary.

Cincinnati, O.—The Licking river bridge, at the foot of Twelfth street, between Kenton and Campbell counties, has been sold to W. B. Sanders, of Cleveland, O., for $125,000.

Dillon, Mont.—Sealed proposals will be received until April 17 for constructing two bridges over the Big Hole river, one at Fox's and one at Wisdom. T. J. Murray, County Clerk.

Cumming, Ga.—The contract will be let at public outcry, April 29, for a bridge across the Chattahoochee river, between Forsyth and Gwinnett counties. H. L. Hawkins, Ordinary.

Harrodsburg, Ky.—Sealed proposals will be recived until May 4 for constructing a steel bridge across Chaplin river, about one mile east of Dixville. James L. O'Neal, O. W. Lester, committee.

Waterville, Me.—Messrs. E. J. Lawrence, S. A. Nye and S. F. Gerald have been appointed a committee to arrange for building an iron or steel bridge at Fairfield, to replace the one washed away.

Atlanta, Ga.—Sealed proposals will be received until May 6 for a bridge over Peachtree creek, on Peachtree road, about five miles from this city. Certified check, $250. Anton L. Kontz, clerk com'ts and revenues.

Conneaut, O.—The estimated cost of the proposed overhead bridge to begin at Maple avenue, and reaching to Madison street, is about $22,950. For a 7-track under crossing, the cost is placed at $7,964, and for a 48-track under crossing it is placed at $49,995.

PARKS.

Miles City, Mont.—The city park will be improved.

Kinsley, Kas.—A new city park is contemplated.

Detroit, Mich.—About $100,000 will be appropriated for parks and boulevards. Clark park is to be improved also.

Mokena, Ill.—The piece of ground known as the village park will be improved by filling in, sodding and planting trees.

Hickman, Neb.—The park will be improved and beautified by establishing a boat and fish pond and making other improvements.

Columbus, O.—The citizens of Lorain-st. are planning to widen that thoroughfare from the city limits to Rocky river to 100 feet.

Cincinnati, O.—A general plan will probably be considered at an early date by the B. of A. for opening one-lot spaces and making them attractive resting places for the public.

Chicago, Ill.—Lincoln park will be extended to Evanston. The project will probably be undertaken this year. The Jackson-st. boulevard ordinance passed council, March 3, with an amendment which imposes an obligation of the West park board never to grant permission to

any street railway company to lay tracks on the street.

Dayton, O.—The Dayton chapter, Daughters of the American Revolution, have been given full authority to plant such flowers, vines, shrubs and trees and to beautify in such manner as they see fit, the grounds of the Van Cleve park.

Los Angeles, Cal.—Some valuable suggestions relating to park improvements were made by Mr. Joseph Earnshaw, a landscape engineer of Cincinnati, while on a visit to this city recently. The suggestions were in response to a request made by the mayor and board of park commissioners. The further improvement of Elysian park is urged by the press.

Toledo, O.—The park commissioners are considering a plan for beautifying the principal streets of the city. The board has more plants than can be utilized to advantage, and it is proposed that the shrubs be loaned to residents on those principal streets, to be planted and protected by the residents on the vacant space between the sidewalk and curb.

STREET LIGHTING.

Woodburn, Ore.—This town has voted to bond for an electric light plant.

Social Circle, Ga.—An electric light plant will be established here. J. L. Watkins is interested.

Lawrenceburg, Ky.—An electric light plant will be erected. John P. McWilliams can give information.

Irvington, Ind.—The citizens will vote on the construction of a light and water plant April 6.

Williamsport, Ind.—The city council has decided to construct an electric light plant at a cost of $15,000.

Lynchburg, O.—Sealed proposals will be received until April 9 for constructing an electric light plant. Thomas Montgomery, clerk.

Muscatine, Ia.—The report of City Engineer Hay shows that arc street lights cost the city $132 each per year under contract.

Madison, Ind.—Bids are asked until April 8 for furnishing and constructing an electric light plant. Also an electric railway three miles long.

Electric light plants are contemplated at the following places: Salisbury, N. C.; East Fairfield, Vt.; Corinth, N. Y.; Mohawk, N. Y.; Worthington, Ind.; Oakcliff, Tex.; Highland Park, Mich.; Portland, Mich.; Wapello, Ia.; Gillett, Col.; Hamburg, N. Y.; Cadiz, Ky.; Hart, Mich.; Alden, Ia.; Howard Lake, Minn.

STREET CLEANING.

St. Paul, Minn.—Sealed proposals will be received until April 6 for sweeping by hand Summit-ave. and other streets; also for the collection of the sweepings from these thoroughfares. R. L. Gorman, president board of public works.

Albany, N. Y.—Mayor Thatcher will suggest a change in the method of cleaning streets and collecting dirt. Street Commissioner Gaus moved that bids be advertised for removing the street dirt in the same manner as heretofore, with the exception that the contractor will be required to pick up the dirt within four hours after the street has been swept. This was opposed by the mayor, who will endeavor to adopt a new and more satisfactory plan.

Brooklyn, N. Y.—Bids were received March 10 for street cleaning. The amount of street cleaning is placed at 19,000 miles per year. Asphalt and brick pavements are reckoned as double, and certain granite block and other streets as treble mileage, and the removal of snow will be practically figured as street cleaning. Asphalt or brick paved and certain granite street must be cleaned by men constantly employed thereon at least three times daily. Macadamized streets are to be cleaned from time to time, as ordered, by hand brooms. All streets, except asphalt or brick, must be sprinkled before cleaning, the water to be furnished by the city without charge to the contractor. The contract will be let for three years from April 1, 1896. McKeever Bros. will secure the contract, it is thought. Their bid was $17.70 each year for streets; for ashes, $220,000 for 1896, $229,000 for 1897 and $249,000 for 1898.

STREET SPRINKLING.

Evansville, Ind.—T. Campbell, Carmi, Ill., was awarded the contract, March 10, for sprinkling a number of the streets for the seasons 1896 and 1897 at $28 per 10,000 square feet.

Indianapolis, Ind.—The board of public works awarded the contract, March 16, for street sprinkling. The bids for each 10,000 square feet of surface ranged from $25.20 to $38. Fuehring Bros., Theodore Brown & Co., Robert Thomas, H. T. Nolting, Rust & Roepke, City sprinkling company and J. R. Kennington Bros., were the successful bidders.

GARBAGE DISPOSAL.

Albany, N. Y.—Bids will be received until April 6 for taking up and renewing street dirt from five districts. Thos. J. Lanahan, clerk.

Chicago, Ill.—A contract has been made with the Anderson garbage and reduction company to burn all garbage delivered at its works for 65 cents per ton.

Los Angeles, Cal.—The committee has recommended that a contract be made with J. B. Franklin for three years for collecting and cremating the garbage.

San Jose, Cal.—Mayor Austin and Councilmen Nolting, Jarman and Hogan have been appointed a committee to investigate the question of purchasing a garbage crematory.

Indianapolis, Ind.—Action is urged in regard to a garbage collection contract by the health department. The present service is very unsatisfactory owing to the irregular system of collection. The Indianapolis dessicating company has the contract with the city now.